INTEGRATING INTERACTIVE TECHNOLOGIES

A PRACTICAL APPROACH

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Statements and Declarations

Declaration of Originality

This thesis contains no material which has been accepted for a degree or diploma by the University or any other institution, except by way of background information and duly acknowledged in the thesis, and to the best of my knowledge and belief no material previously published or written by another person, except where due acknowledgement is made in the text of the thesis, nor does the thesis contain any material that infringes copyright.

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Abstract

Access to technology in schools has increased in the past decades, partially due to funding programs such as *Building the Education Revolution* (Australian National Audit Office, 2010). This increase has reduced the inequity of access between schools (Diogo et al., 2018; Watkins et al., 2015). However, research (e.g., Brown & Czerniewicz, 2010; Gallardo-Echinique, 2014; Wang et al., 2014a) has found that, alongside this increased access, there is evidence of a growing gap between different teachers' skills when technology is used in teaching and learning. Researchers, such as Sinpeng (2015), suggest that there should be a shift from simply procuring technologies to implementing strategies in order to build teacher capacity in integrating technologies for teaching and learning.

This study examined the factors that contribute to teachers' abilities to integrate interactive technologies into classroom practice and how a professional learning model, specifically designed for this study, can facilitate the building of teacher capacity when teachers use technology to support teaching and learning. The mentoring structure within this professional learning model is supported by templates specially designed for the study and a technology integration framework, which was developed from other integration frameworks. The study targeted primary learning spaces, since research in primary school settings and, therefore, evidence-based exemplars for primary school teachers are less common than in secondary and tertiary settings (Blannin, 2015).

A qualitative approach was adopted in this study, taking the form of a comparative case study across five schools. These schools were located in NSW, Australia and included teachers with varying levels of experience.

Each participating school included mentor and mentee partners who aimed to engage in six cycles of observation and reflection. During each cycle, the mentor would observe a lesson presented by the mentee, which was followed by a meeting where the partners would reflect on the lesson observed. The mentor used the templates to capture the mentee's progress against the framework, record milestones for the mentee to achieve and note suggested strategies for the mentee to use in order to achieve the milestones. The mentor submitted as data recorded meetings and the completed templates. The participating teachers also submitted a post-study survey, which allowed them to reflect on the learning process and provide feedback about the specific elements of the professional learning model, the framework and the supporting templates. The data analysis was initially framed by the themes identified from existing research, but new themes were allowed to emerge through an open coding process. Results from the schools provided an insight into the factors and themes that were relevant for each school's unique context.

Findings from this study included common factors that affected the ability of the mentee teachers to integrate technologies. Firstly, access to technology, in terms of availability and reliability, remained an issue in the primary schools. Other factors included teachers' and students' expertise and attitudes, and educational system and school leadership support. The need for dedicated time to engage with the professional learning in this study was commonly mentioned by the teachers. Despite the varying ability of the teachers to engage with the professional learning model, all mentees demonstrated growth measured against the framework and, at the end of the study, most teachers, both mentors and mentees, were confident in their ability to mentor others to integrate technologies into teaching and learning. The key factors needed to facilitate the professional learning that emerged were the need for a strong mentor-mentee relationship, an appropriate mentor and a teacher's positive attitude towards the professional learning process. Not only did the participating teachers respond positively to the professional learning model, the framework and the supporting templates used in this study, they also provided evidence and feedback for suggested refinements to these mechanisms.

This study contributes to the greater body of research by fostering a better understanding of the factors that impact on the ability of primary teachers to integrate technologies into teaching and learning. It provides a sound professional learning model, supported by an explicit technology integration framework, to build teacher capacity when integrating technologies.

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Whatever you do, do it all for the glory of God.

1 Corinthians 10:31

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List of abbreviations

Abbreviation	Explanation
ABS	Australian Bureau of Statistics
ACARA	Australian Curriculum, Assessment and Reporting Authority
AITSL	Australian Institute for Teaching and School Leadership
BYOD	Bring Your Own Device
CIL	Computer and Information Literacy
CK	Content Knowledge
DFAT	Department of Foreign Affairs and Trade
DoE	NSW Department of Education
DP	Deputy principal
HREC	Human Research Ethics Committee
ICSEA	Index of Community Socio-Educational Advantage
ICT	Information and Communication Technology
ICTL	Information and Communication Technology literacy
ISTE	International Society of Technology in Education
IT	Information Technology
IWB	Interactive whiteboard
LBOTE	Language Background Other Than English
LSLD	Local Schools, Local Decision educational reform
MCEETYA	Ministerial Council on Education, Employment, Training and Youth Affairs
NAP	National Assessment Program
NAP-ICTL	National Assessment Program for Information and Communication Technology Literacy
NAPLAN	National Assessment Program for Literacy and Numeracy

Abbreviation	Explanation
NESA	NSW Education Standards Authority
NRI	Networked Readiness Index
NSW	New South Wales
OECD	Organisation for Economic Co-operation and Development
PCK	Pedagogical-Content Knowledge
PIN	Personal Identification Number
PIRLS	Progress in International Reading Literacy Study
PK	Pedagogical Knowledge
PISA	Programme for International Student Assessment
QR	Quick Reference
RAM	Resource Allocation Model
RFF	Release from Face-to-Face
SAMR	Substitution, Augmentation, Modification, Redefinition
SERAP	State Education Research Application Process
TALIS	Teaching and Learning International Survey
TCK	Technological-Content Knowledge
TIMMS	The International Mathematics and Science Study
TK	Technological Knowledge
TPACK	Technological-Pedagogical-Content Knowledge
TPK	Technological-Pedagogical Knowledge
T4L	Technology for Learning
USB	Universal Serial Bus

CHAPTER 1
CONTEXT AND INTRODUCTION

The aim of the study reported in this thesis was to assess the viability of a professional learning model to support teachers in building their capacity to use Information and Communication Technologies (ICT) in teaching and learning. This chapter describes the background and context, and then outlines the rationale and relevance of the study in greater detail. There follows a brief outline of the research paradigm in which the study is situated and a summary of the research methodology. Finally, an overview of structure of the thesis is presented.

In studies in this area, the terms *information and communication technology*, *digital technology* and *interactive technology* have been used interchangeably in the literature to denote the same topic. Therefore, this thesis will also use these terms interchangeably, in the same sense that they are used in the Australian curriculum, which is:

> … digital systems such as mobile and desktop devices and networks [that] are transforming learning, recreational activities, home life and work … [and that] support new ways of collaborating and communicating …
>
> (Australian Curriculum, Assessment and Reporting Authority [ACARA], n.d.a.)

1.1 Background

My experience as a classroom teacher and computer coordinator across multiple schools sparked a long-time interest in effective technology use and integration. During my time in schools, I witnessed increasingly prevalent use of ICT for different purposes, from teaching and learning to administration. Similarly, the increasing availability of digital technologies was evident in a number of schools.

While it is sometimes argued that schools' technology programs may not have kept up with technology access requirements for teaching and learning (Audit Office of New South Wales, 2017), programs such as *Building the Education Revolution*, its sub-program *National Partnerships* (Australian National Audit Office, 2010) and *Technology 4 Learning* (T4L): *Computer Equipment Rollout* (NSW Department of Education [DoE], 2017a) have increased access to technologies in schools. My experience was that schools aimed to build up their banks of portable digital and other interactive devices, with the intended purpose of exposing students to digital technologies and enriching their learning. However, this was generally based on the assumption that access to technology equated to value and quality of teaching and learning.

The purchase of digital technologies in schools may be, at least in part, due to influences described in Prensky's (2001) theory of *Digital Natives, Digital Immigrants*. Despite some direct criticism of Prensky's theory (Bennett & Maton, 2011; Gallardo-Echinique et al., 2015), it was highly influential. Its popularity with educators and the subsequent criticism elicited new research that added knowledge about ICT usage and adoption (e.g., Brown & Czerniewicz, 2010; Gallardo-Echinique, 2014; Wang et al., 2014a). This research revealed that regardless of age or generation, there exists a gap between different teachers' skills when using ICT. Therefore, it was not unexpected to see researchers, such as Sinpeng (2015), suggest that resource expenditure shift from procuring technologies to strategies such as professional learning, in order to support teachers in using ICT for teaching and learning. This was a suggestion that reflected my experiences in schools.

My previous study which explored teacher preparedness when using interactive whiteboards (IWBs) found that teachers were not prepared for the influx of digital technologies in their learning spaces (Wong, 2013). Further conversations with my colleagues identified that the need for preparing teachers in integrating technologies was not restricted to the small number of participants from the previous study but was a more widespread problem. These conversations revealed common themes, including teachers' desire for:

- something that is easy to use to build their integration skills
- knowledge of what can be done with available technologies
- training that does not add to the time burden of the profession.

These needs prompted my personal interest in developing a professional learning program with a practical classroom focus, grounded in current studies and theoretical approaches in the literature.

An initial review of the available literature revealed the need for a study into the integration of ICT in the primary school context. A vast number of educational research studies on the use of digital technologies in Australian schools has been conducted, as will be detailed in the literature review in Chapter 2. The purpose of these studies has been to provide up-to-date research for schools and teachers as exemplars of ICT integration (White, 2014). However, Blannin (2015) considered that studies of ICT integration had not yet focused on the primary school setting. Studies in the secondary and tertiary settings are not necessarily transferrable to the primary school context and, therefore, primary teachers do not have the appropriate exemplars for digital technology use (Blannin, 2015). This is of a particular concern to me, due to my background as a primary teacher and leader.

Another reason for conducting a study into ICT integration is the imperative that teachers be models of effective ICT use for their students. The National Assessment Program in ICT Literacy (NAP-ICTL) has shown that there has been a sharp decline in students' ICT Literacy (ICTL) over the past few years (ACARA, 2015, 2018a). The Ministerial Council on Education, Employment, Training and Youth Affairs (MCEETYA) (2005) defined ICTL as the use of ICT to:

- access and use information
- develop new understandings
- participate effectively in society.

The NAP-ICTL tests a representative sample of students in Years 6 and 10 across Australia every three years. The same sets of skills are tested every cycle, but the contexts are updated to ensure that the tests remain relevant to the students. When this study began, the available report of the 2014 assessment showed that results in most of the states and territories declined in both Years 6 and 10 (ACARA, 2015), and that the NSW score recorded the second highest drop in Australia. Since 2014, another assessment has been administered, which again showed that the results for Year 6 in most states and territories either remained the same or dropped (ACARA, 2018a). In comparison with the 2014 assessment, there was an improvement for Year 10 students in NSW. However, these Year 10 results are still not equal to or above those reported from the earlier assessments (in 2005, 2008 and 2011). This evidence suggests there needs to be significant changes to turn around the decline.

The literature suggests four compelling reasons why intervention should occur at the school and teacher level. The first reason concerns students' habits of digital device use at home and at school. While the 2014 NAP-ICTL assessment report (ACARA, 2015) revealed that students' use of digital devices had decreased at home but increased in schools, the 2017 assessment report showed that this had since reversed (ACARA, 2018a). Across Australia, 20% more Year 6 and 7% more Year 10 students were using devices outside of school than at school. In NSW, the difference was 21% more Year 6 students and 15% more Year 10 students. Despite this increased use outside of school, students were more likely to use entertainment applications on digital devices, with the exception of music applications use at school for Year 10 students (ACARA, 2018a).

These data show that students are more likely to use technologies productively at school. This aligns well with the second compelling reason for intervention at school and teacher level, which is that schools and teachers are commissioned to develop students who are " … creative and productive users of technology, especially ICT … " (MCEETYA, 2008, p. 8). Thirdly, it has been shown that effective use of ICT in teaching and learning at school has the potential to provide greater links between school learning and real-life applications, leading to greater engagement and improved understanding of the curricula (Prieto-Rodriguez, 2015). These three reasons, in particular, reveal the urgency in ensuring effective and productive ICT integration in schools.

The fourth reason for this kind of intervention is that while there has always been, and most likely always will be, a need to provide professional learning to teachers in the integration of technology, this is an opportune time to provide this support. A survey of teachers, titled *Teaching and Learning International Survey* (TALIS), is issued every five years by the Organisation for Economic Co-operation and Development (OECD) to gather international feedback from teachers relating to their working conditions and learning environments in schools. The report of the TALIS 2013 (OECD, 2014) revealed that the second and third most cited areas of need for professional learning were related to teaching with ICT. This need remained high in the more recent TALIS 2018, where the second most cited area of teachers' professional learning needs was the use of ICTs in teaching (OECD, 2019a, 2019b). Also, recent years have seen the mandated implementation of three curriculum documents in this area. First was the implementation in 2018 of the *Australian Curriculum: Digital Technologies* (ACARA, n.d.b) for students in Foundation (ages 5–6 years) to Year 8 (ages 13–14 years) (Masters, 2018). More directly impacting NSW schools were the new *Science and Technology K–6* and the *Technology Mandatory Years 7–8* syllabuses, which were required to be implemented by NSW schools in

2019 (NSW Education Standards Authority [NESA], 2017a, 2017b, 2018a). These new NSW syllabuses incorporate the latest student outcomes in the use of digital technologies. The three documents reflect the prioritisation of digital technologies in the curriculum and the need to provide teachers with the necessary skills to deliver the required learning to their students.

My experience observing many classroom teachers has been that uptake and integration of ICT have not been widespread. While technology has been procured for learning spaces, teachers may not have had the appropriate preparation to adopt these new technologies into their teaching and learning (such as seen in Wong, 2013). This is despite the requirement that all teachers in NSW, as of 2018, were to be accredited at the Proficient level (DoE, 2018a; NESA, 2018b; Teacher Accreditation Act 2004 (NSW)). This level requires that teachers are able to " … use effective teaching strategies to integrate ICT into learning and teaching programs to make selected content relevant and meaningful" (Standard 2.6, Australian Institute for Teaching and School Leadership [AITSL], 2017a, n.p.; Standard 2.6.2, NESA, 2014, p. 11). Similarly, studies have shown that teachers do not integrate digital technologies into their teaching because of their low-level (or perceived low-level) skills in ICT, or their negative attitudes towards ICT (Coleman et al., 2016). Gibson et al. (2014) and Ritzhaupt et al. (2012) found that more positive attitudes towards, and confidence in, integrating interactive technologies, achieved as a result of professional learning, affect student learning. It appears that quality professional learning provides a solution to both building teacher capacity and improving teacher attitudes toward ICT use.

There are currently two issues that affect teachers' ability to engage with professional learning for integrating technologies. Firstly, for those teachers in schools within the major educational jurisdictions in NSW, professional learning is driven by the priorities of the schools and educational systems. In the Catholic

Schools system, priorities are drawn from strategic documents such as *New Horizons* (Sydney Catholic Schools, 2018). It can be reasonably assumed that school priorities would also affect the professional learning of teachers from other schools in the independent sector. Similarly, the expectation for DoE teachers is that teachers' *Professional Development and Performance* plans will align the majority of their performance and development goals to their schools' plan (DoE, 2016). While there is some local control by principals at a school level, under the *Local Schools, Local Decisions* reform (DoE, 2017b), school plans must adhere to DoE priorities, which can be found in documents such as *Strategic Plan 2018–2022* (DoE, 2018b). When schools do not prioritise integrating interactive technologies, teachers' *Professional Development and Performance* plans cannot prioritise the integration of ICT, unless it is accepted as the teachers' only personal goal.

Secondly, although DoE teachers taught the majority (65.6%) of NSW students in 2017 (Australian Bureau of Statistics [ABS], 2019a), these teachers had limited opportunity to participate in professional learning about ICT integration (Audit Office of New South Wales, 2017). As of April 2017, only 34 courses relating to integrating ICT were available within the DoE system, of which eight allowed teachers to accrue hours for maintaining their accreditation (Audit Office of New South Wales, 2017). Due to the existence of numerous professional learning providers in NSW, it was difficult to determine comparable statistics reflecting the number of courses available from other providers. Although 34 courses may seem a reasonable number, the spread of these courses across NSW is insufficient to address the needs of NSW teachers. This scarcity appears especially stark when considering that, in 2017, there were 58,539 teachers in 2,151 NSW Government schools (ABS, 2019b, 2019c). The audit did not examine the effectiveness of these courses, nor whether they targeted the specific learning needs of teachers from diverse contexts. Providing sufficient access for teachers to engage with professional learning for integrating interactive technologies requires not only increasing quantity, but also providing localised solutions for the teachers. Localised solutions provide professional learning that accounts for contextual factors and bring greater relevance to the learner (AITSL, 2014).

1.2 Purpose and significance

One of this study's aims is to provide an example of a localised professional learning opportunity and how this example can be used to build teacher capacity in the integration of technology. The literature suggests that such professional learning opportunities must target both skills and attitudes of the teacher, so that teachers and school leaders can see genuine benefits in ICT use and integration, rather than just the need to comply with policy and curriculum (Bayar, 2014; Cleaves & Toplis, 2008; Jones & Dexter, 2014).

In providing these opportunities, the study sought to contribute to the literature in the following three areas. The first was to reach a better understanding of the factors impacting on the ability of teachers to integrate interactive technologies in a primary setting. Secondly, the study examined a mentoring structure that could be added to the professional learning activities available to teachers to facilitate the building of their capacity when integrating ICT. The aim of this mentoring structure was to make available a sustainable, effective and practical model for professional learning to schools. Finally, the study tested a framework that could be readily implemented, together with the mentoring structure, by teachers and schools. While the TPACK (Technological-Pedagogical-Content Knowledge) Framework has been used widely in the literature (e.g., Joo et al., 2018) and in this study, two of the main criticisms of the framework are its lack of practical application and links to the context (McLoughlin, 2015). In this study, the new framework, as described in section 3.4.1, adopted some of the key benefits from four integration frameworks, including the

TPACK Framework, to provide an appropriate support mechanism for the mentoring implemented and examined in this study.

In contrast to King's (2014) assertion that most studies in professional learning target teacher satisfaction, this study tested the mentoring structure in terms of its impact on changing teacher practices and attitudes.

This study also aimed to contribute to the wide body of research available on the use of digital technologies in learning spaces. As Niess (2011) emphasised, there remained a need for research to describe teachers' development of knowledge, skills and values when incorporating new and emerging technologies. Given that there is only limited available research in this area for primary teachers (Blannin, 2015), this study investigated practice in a primary school setting, to find evidence that might support a mentoring-based form of professional learning for integrating interactive technologies in the primary context.

The overarching objective was to produce a professional development toolkit that could build teacher capacity in primary settings. To explore the complexities involved in such a challenge, the following research questions were framed:

1. What factors influence the way primary teachers integrate interactive technologies in their learning spaces?
2. What features of a mentoring model can facilitate building primary teachers' capacity for integrating interactive technologies?
3. In what ways can a structured technology integration framework facilitate professional learning?

1.3 An introduction to the research paradigm

Prior to examining in more detail the research study reported in this thesis, the ontological and epistemological approaches assumed in this study must first be presented. Ontology, in social science studies such as this, decides which area of the human world in which knowledge can be acquired, while epistemology examines ways in which knowledge can be constructed (Moon & Blackman, 2014).

Ultimately, the paradigm adopted in this study informed the way in which the research was designed, and how the data were collected, analysed and reported. The theoretical approaches adopted were pragmatism (in its ontology), critical constructivism (in its epistemology) and interpretivism (in its analysis approach). Despite the fact that these theories are introduced separately here, these are interwoven across the research design. Specifically, more details of the research paradigm and how it has been applied to this study are provided in section 3.1. Similarly, the short overview of the study design and analysis approach presented in the following section are described in greater detail in Chapter 3: Methodology.

1.4 An overview of the study design

To address the research questions, this study chose a participatory action research approach, using five case studies (Babbie, 2016; Stringer et al., 2010). Justification for this approach is detailed further in the methodology discussion in Chapter 3. Action research provides opportunities for the participants to take an active role in gathering and analysing the data (Kemmis, 2006). Such opportunities are realised in this study through engaging participants, at least one mentor and one mentee from each school, in reflective practices, and ensuring that each participant had a chance to review the behaviours and actions of each lesson observed, based on their expert knowledge of their own context. The process also allowed the participants to contribute to the planning of the follow-up lessons.

The study aimed to engage participants in a six-week program of professional learning, involving an iterative process. A pre-study meeting was held with each group of mentoring partners to familiarise the participants with the process, followed by cycles of the mentors observing the mentees' lessons, and meetings to conduct joint reflection and planning. Participants repeated cycles of observation, reflection and planning, which involved a number of data-gathering processes. The researcher visited each school during each case study, which provided him with some contextual knowledge that assisted in informing the analysis of the data. A follow-up survey was undertaken independently by the participants, providing them with opportunities to reflect on the study.

This study was primarily qualitative, requiring analyses of both the recordings of meetings and the completed templates used in this study. Participants were welcome to provide other relevant data, such as lesson plans. The survey returned feedback from the participants about the instruments used in the study and the mentoring structure, which yielded a small amount of both quantitative and qualitative data.

While the cases started at different times, there was some overlap in the beginning and finishing date of each case. This overlap, as well as the iterative nature of the action research approach, allowed for the analysis of the data to begin early. Data analysis began during the initial cycles of the first two cases, and then continuing throughout the study. The data from all schools were collected over 11 months, spread over four school terms. Although data were not collected during the school holidays, data analysis then continued throughout these times. Coding was the primary analytical method used for this study (Ary et al., 2014; Babbie, 2016). The coding process was first informed by themes which had been identified by existing research and drawn from the literature, and new codes were established through discussion between the researcher and his supervisors. Chapter 3 will provide a more comprehensive description of the methodology, research design and the analysis processes that were employed in this study.

1.5 Structure of the thesis

The thesis is organised into six chapters. This first chapter has described the background and rationale of this research study, provided information on how the study was conducted, and framed the research questions the study sought to address. The remaining chapters are organised as follows.

In **Chapter 2**, the review of literature explores the complexities of integrating interactive technologies in learning spaces. It features the factors that have affected the ability of teachers to integrate interactive technologies; what constitutes effective features of professional development and learning; and how mentoring as a professional development and learning strategy can be an effective tool for teachers. It then describes some frameworks for measuring the success of ICT integration that may be useful in this study.

Chapter 3 outlines the research design that was used in this study. It provides justifications for using action research as a data-gathering strategy and summarises the development of the instruments, the data analysis strategies and the ethical considerations for this study.

A summary of the findings from the study can be found in **Chapter 4**. These findings are presented separately for each case study, allowing the audience to develop an understanding of the findings from each school. Within each case study, the findings are then organised into broad categories drawn from the emerging themes revealed during the data analysis.

In **Chapter 5**, the findings from the previous chapter are discussed. This chapter positions the findings revealed in Chapter 4 to address the research questions originally presented in this introduction chapter. This is done by grouping the findings from each case study together, and then presenting comparisons using the relevant research question and the categories revealed in Chapter 4.

Lastly**, Chapter 6** summarises the findings and highlights the implications of the study. The chapter presents the refinements made to the framework, linking them to the framework-specific feedback and to the findings that were used to address Research Question 3 in Chapter 5. Chapter 6 will also present the key implications from this study, as well as considering potential limitations and suggesting directions for future study. Finally, it provides a summary of the researcher's personal and professional growth as a result of embarking upon this study.

CHAPTER 2
A REVIEW OF LITERATURE

The study aimed to examine the following three areas: the factors that influenced the ability of primary teachers to integrate interactive technologies; the potential for an alternative professional development structure that utilised a mentoring model; and a draft framework for digital technology integration that was tested and refined by teachers. This chapter is structured around these three areas of examination which provide the basis for establishing the methodology and approach to conduct this study.

Since the introduction of digital technologies as teaching and learning tools, a number of studies have been conducted to test the effectiveness of these technologies and to explore their use in schools. To build on this body of research, the factors that impact on the effective technology use in schools needed to be thoroughly explored in order to establish a starting point from which findings emerging from this study can be compared.

Secondly, the literature on mentoring and professional learning was examined in order to determine the key features of effective professional learning and identify the critical elements that influence mentoring effectiveness. These features and elements provided a strong foundation to design a context-based professional learning model and to examine the effectiveness of this model in its implementation.

Finally, to establish the measure or framework, knowledge of existing integration models was required. A number of integration models were considered through an initial search of the literature, with the SAMR (Substitution, Augmentation, Modification and Redefinition) Model (Puentedura, 2015, 2016) and the TPACK Framework (Koehler, 2017) identified as being particularly relevant. Two IWB frameworks (Beauchamp, 2004; Sweeney, 2008) were also examined as they were considered to provide easily understood and step-by-step models.

The body of literature considered was sourced from thorough searches using journal databases (e.g., INFORMIT A+ Education; EBSCO; ERIC and Google Scholar), references from other relevant studies and suggestions from expert librarians. Search terms for databases included: influences and barriers to ICT use; ICT in education; computers in education; technology; teacher attitudes; teacher competencies; computer literacy; pedagogical change; teacher change; mentoring; and effects of professional learning.

Two specific factors contributed to the filtering and final selection of the literature reviewed in this chapter. Firstly, the literature needed to relate to and have impact on the research questions and aims, and on contemporary practices in technology integration and professional learning. The second factor was a need to find more recent studies, due to the rapid development of new technologies and ongoing studies into professional development and learning.

To find the appropriate literature for review, an initial examination of the abstracts of potential articles was conducted. This was followed by a more detailed reading of the articles that appeared to be relevant. Those articles that were older than the age criterion, published earlier than the past 10 years, but were mentioned in relevant and more recent articles were also considered.

2.1 Factors contributing to achieving integration mastery

There are a number of existing research studies that have explored the areas of ICT integration in schools. However, Howard and Thompson (2016) found that these have not provided a group of agreed factors and issues that affect teachers' ability to integrate technologies. Despite this lack of agreement, a number of common factors were identified in these studies and are discussed in the following sections, under the broad themes of:

- access to quality technologies
- educational system and school leadership support
- teacher expertise, attitudes and beliefs.

While these have been identified as separate factors, it is important to consider them holistically. Such factors are interwoven; interacting with, relating to and depending upon each other (Levin & Schrum, 2014). Educational system support, as used here and in other parts of this thesis, refer to leadership support that comes from the educational system level, which is beyond the individual school level.

2.1.1 Affordances of technology in education

Before exploring those factors that affect teachers' mastery in integrating technologies, it is appropriate to examine the reasons behind why a teacher should integrate technology at all. To do this, this section explores the affordances of technology in education and examines how these affordances can improve students' learning experiences.

The term 'affordances' was originally coined by Gibson (1977), who described affordances as ways in which one may action possibilities. Since then, other definitions have been developed to better understand this term. Specifically, Haines (2015) defined the affordances of technology in education as " … the potential that teachers perceive in a particular technology tool that will support learning and teaching activities in their educational contexts" (p. 166). Affordances of different objects can vary greatly (Gibson, 1977) and, as more technologies become available, teachers are finding it hard to take advantage of all the affordances that available technologies can offer (Haines, 2015). Therefore, it would be impossible to list all the individual technology's affordances that can be provided to teaching and learning. Haines (2015) also warns that the perception of the affordances is specific to each individual teacher, their experiences, and their intentions for teaching and learning.

Therefore, this section can only outline some general affordances that technologies can provide to education.

Across the literature, it has been argued whether there is sufficient evidence to support technology use in education based on the benefits that it yields. For example, the OECD (2015) reported that the data gathered from the Programme for International Student Assessment (PISA) suggested that resources invested into ICT in education do not necessarily link to improved student outcomes. In fact, in countries where the internet is used less commonly for schoolwork, students' reading results tend to improve more rapidly (OECD, 2015). Similarly, Hattie's (2013a) meta-analyses showed that computers' effect on learning was no different than the effect typically found in well-intentioned traditional teaching approaches. Drijvers (2018) also reported, in his review of several meta-studies, that technology only made small differences to student outcomes in the subject of mathematics and that these differences appeared to be more pronounced in primary than in secondary education. Therefore, it seems reasonable to question the place of technology in education, given that it affords limited positive changes to student achievement.

While the literature has reported that technology cannot simply afford benefits to student outcomes, it also reported other benefits that technology can afford to education in general. It should be noted that technology's beneficial affordances can only be realised when technology is integrated into traditional teaching practices, rather than fully adopting the role of the teacher (Bulman & Fairley, 2015; Hattie, 2013a). When technology integration is effective, some of the technology's beneficial affordances to education include:

- transforming teaching and learning to focus on the student, rather than the teacher (McKnight et al., 2016)
- allowing students to search and acquire new knowledge beyond what would be available from local resources (such as books and teachers)

(OECD, 2015). This also includes benefits for teachers by improving their access to resources (McKnight et al., 2016)

- empowering students to express their views and demonstrate their learning to a wider, global audience (Hazari et al., 2009)
- allowing students to practise their skills and learn at their own pace (Bulman & Fairley, 2015; Hazari et al., 2009; OECD, 2015)
- allowing students to directly interact with their learning, independent of the teacher (Hazari et al., 2009)
- extending or integrating time and space in which learning can take place (Bulman & Fairley, 2015; OECD, 2015)
- individualising learning to attend and extend each student's skills and knowledge (Bulman & Fairley, 2018; Hazari et al., 2009)
- allowing teachers to monitor each student's progress, even when students are learning at their own pace and abilities (Bulman & Fairley, 2018; McKnight et al., 2016)
- enhancing communication pathways between teachers, students and parents/carers to allow for collaboration and feedback (McKnight et al., 2016).

For effective technology integration to occur and, therefore, for these beneficial affordances to be realised, two factors emerged from the literature. First, technology use in education can be affected by barriers such as infrastructure and access to technologies (McKnight et al., 2016; OECD, 2015). Second, benefits would only result when technology integration aligns appropriately with accepted effective learning principles (McKnight et al., 2016). For example, OECD (2015) found that technology-related activities are particularly effective when the students take control of their learning, such as controlling the pace and specific content. There also appeared to be higher effect sizes when technology use was integrated into learning activities that focused on concept acquisition and problem solving, and supported the teaching role (Drijvers, 2018). As mentioned, it is generally agreed that technology cannot replace effective teaching and learning, but rather that its affordances can only be realised beneficially when it complements effective pedagogies (Drijvers, 2018; Hattie & Yates, 2013; McKnight et al., 2016). The benefits listed above, as well as the factors mentioned here, would require teacher permission. There also appears to be an emphasis on the importance of the teacher being able to leverage the beneficial affordances of technology in education. Therefore, aligning with these factors, the following sections will explore teachers' and students' access to technologies, followed by teachers' skills and abilities to take advantage of their technologies' affordances.

2.1.2 Access to quality technologies

While over the past two decades, the divide in the teachers' and students' access to quality technology across schools has reduced (Diogo et al., 2018; Watkins, Engel, & Hastedt, 2015), there is still evidence of varied, and sometimes limited, access (Audit Office of New South Wales, 2017; Day, 2013; Lawrence & Tar, 2018). This varied access can affect ICT integration at a school level, where it has been found that teachers were more likely to integrate ICT when they had greater access (Albion et al., 2015; Andrade & Coutinho, 2019; Liu et al., 2017). In particular, a teacher from Andrade and Coutinho's (2019) study expressed her reluctance to teach in a school where there was limited access to technologies. Studies, such as those by Albion et al. (2015) and Liu et al. (2017), emphasised that access to quality ICT in learning spaces is a necessity for teachers' effective use.

Impact of access on teachers and teaching

An example of this need for quality ICT was seen in the *Riverina Access Program* (Harriman et al., 2016). Rural and remote schools within the NSW

Government sector are sometimes grouped together into clusters. Classes, made up of students from across the cluster of schools, are taught remotely using ICT, allowing a broader range of subject choice for students, especially in Years 11 and 12, the final two years of schooling in NSW. This enables students to access teachers with different areas of expertise and allows the cluster to offer subjects which may not be normally available to students in their local schools. Teachers use a variety of technologies including video conferencing, *Adobe Connect* and learning management systems such as *Moodle* and *Canvas*. Used in this way, ICT allows students to communicate with both their teacher and other students, resulting in a feeling of belonging to the class group (Harriman et al., 2016).

However, problems with access to technology as an inhibitor of successful use of ICT for teaching and learning was reported in the *Riverina Access Program* evaluation (Harriman et al., 2016). The problems resulted from the disparity of access to quality technologies between different schools within the same cluster, and even within a single school. Consequently, teachers and students were unable to link up with each other. Furthermore, unreliable digital technologies sometimes caused problems during lessons which the teachers were not equipped to remedy. The evaluation found that these issues impacted heavily on effective lesson delivery.

The evaluation, however, acknowledged that access to quality technologies has greatly improved in the past two decades. There has been a vast improvement in device robustness in schools, as well as connectivity and longevity (Haydn, 2014; Jenkins, 2006; Newhouse, 2014; Tallvid, 2016; Wang et al., 2014b). In Australia, problems with outdated and low-quality devices and infrastructure, such as lack of electrical power points and appropriate furniture, have been remedied, at least partly, by federal and state funding (Newhouse, 2014) and through additional funding, as seen in the *Riverina Access Program* (Harriman et al., 2017). In contrast, however, infrastructural limitations have remained an issue in certain schools as shown in

Lawrence and Tar's (2018) study on facilitators and barriers to a teacher's ability and willingness to integrate ICT. Admittedly, however, participants in Lawrence and Tar's study came from the developing country of Nigeria, where problems with electricity and internet reliability were evident.

Improvement in the access to and the maintenance of technology in NSW Government schools can be made possible through different funding and resource deployment models. Most notable of these models are the *Resource Allocation Model* (RAM) (DoE, 2018c, 2018d) and the T4L program. RAM was phased in after the initial implementation of the *Local Schools, Local Decisions* (LSLD) reform (DoE, 2018e), and includes a funding allocation for computer coordinators. Traditionally, this allocation has been used for technology-related activities and resources, such as professional learning and the release of computer coordinators to perform ICT related duties (NSW Teachers Federation, 2011). At the principal's discretion, the computer coordinator allocation in the RAM funding can also be used to improve the access to quality technology within their school. Additionally, a school is allocated a redeeming 'credit' through the T4L program (DoE, 2017a). Each school is allocated one credit for every eight students each year. These credits can be used to redeem for new computer hardware and peripherals from the T4L catalogue.

A recent audit was conducted in partnership between the DoE and the Audit Office of New South Wales (Audit Office of New South Wales, 2017). The purpose of the audit was to assess the implementation and use of ICT across DoE schools. The audit found that although the T4L program has provided a computer renewal service annually to DoE schools, through the redeeming program described above, the program did not cater for the current demands of using ICT in teaching and learning, as access to technologies remains a problem in many schools. As a result of this, there are many older, unreliable and unsupported technologies in use in schools (Audit Office of New South Wales, 2017). While the audit reported that most teachers are using some form of ICT in their teaching and learning, it also reported that there needs to be increased access to improved ICT and digital learning resources for teachers, as well as support for technology use.

Impact of access on students and learning

Andrade and Coutinho (2019) found in their study about flipped learning environments that a lack of access to technologies at home limited students' ability to access their learning. In particular, other studies, such as one conducted by Eikelmann et al. (2017), have found a direct correlation between access to technology and student achievement. These authors found students who had better access to technologies outperformed those with less access (Eikelmann et al., 2017). When access to technologies was equalised between students, the difference in their achievement was no longer notable (Blannin, 2015; Eikelmann et al., 2017). Additionally, improved and increased access to ICT in schools resulted in better outcomes for students from low socio-economic backgrounds, who generally had poorer access at home (Eikelmann et al., 2017). This uneven distribution of technology access based on a student's socio-economic status was also found in the study by Diogo et al. (2018). This study showed that students from higher socio-educational families tended to have better access to technology at home when compared with students from lower socio-educational families. Similarly, Lee and Levins (2010) warned teachers not to assume that students' access to technology at home is equal, despite the findings from their study showing that such access was becoming more consistent across homes. The implications of varying levels of access to technology at home and at school are far-reaching. A person's employment prospects, and issues relating to physical and mental health could be linked to their access to technologies (Broadbent & Papadopoulos, 2013).

It's not all about the devices

Studies concerning ICT integration revealed that extending teachers' exposure to technologies yielded more positive attitudes in teachers, and more enabling school cultures and climates for ICT integration (Levin & Schrum, 2014). However, increased access to technologies has been shown to result in both acceptance and reluctance towards the technologies on the part of teachers (Newhouse, 2014; Tallvid, 2016). Tallvid (2016) explained that teachers can be enthusiastic about using technology for one purpose, such as administration, but reluctant to use it in teaching and learning activities. This adds additional complexities to understanding teachers' willingness to use technology, as their willingness may be related to enthusiasm regarding new technologies (Newhouse, 2014) or to using technologies for a variety of purposes (Tallvid, 2016).

The prioritisation of developing digital literacies in students across the world has led to schools procuring the newest technologies (Sinpeng, 2015). In fact, Australian schools have been found to be comparatively better resourced in terms of digital technologies than schools elsewhere in the world (Masters, 2018). However, there has been little evidence that improved technology integration has resulted from improved access (Hauge, 2014; Tallvid, 2016). Similarly, the substantial investment schools have made to implement IWBs may be at risk through ineffectual use (Sweeney, 2013). It can, therefore, be argued that technology use and professional learning which target meaningful technology integration need to be prioritised (Ertmer & Ottenbreit-Leftwich, 2013; Sinpeng, 2015). Further support for this prioritisation comes from Van Rooy's (2012) study, which found that secondary biology teachers were able to deliver successful teaching and learning activities to their students, despite encountering technology limitations during the lessons.

Newhouse (2014) examined the long-term effects of the first one-to-one (one device per student) program in Australia, 20 years after its initial implementation.

Newhouse did not negate the need for access to quality technology, having considered the improvement of technologies and infrastructure over the years. He agreed that students needed devices, but insisted that teaching and learning should not revolve around the nature of the device. He argued that the decision to choose a technology should begin with the learning and other needs of the students.

Similarly, a study conducted by Watkins et al. (2015) examined the development of computer and information literacy (CIL) skills in students. One of the key recommendations of this study was the need to invest in teacher education and professional learning that targeted teachers' acquisition of the necessary skills and knowledge to enhance their students' CIL. This study showed that the difference in priorities relating to and targeting CIL education varied between schools and educational systems, resulting in a divide forming between those who could use technology meaningfully and those who could not (Watkins et al., 2015). This problem is further compounded by the fact that students from higher socio-educational families were more likely to have support from their families to build the skills needed for meaningful use of technologies (Diogo et al., 2018). This resulted in differences in student abilities in using technology at school. Diogo et al.'s (2018) study, alongside others (e.g., English Teachers' Association of New South Wales, 2006), suggests that the remedy to the unevenness of students' technology skills and ways to equalise socio-economic advantages for students rely on the actions of teachers, schools and educational systems.

The literature described in this section poses the premise that building teachers' and students' capacity to use technology purposefully, and for teaching and learning is more complex than just a matter of access. To quote Watkins et al. (2015, p. 6), "Simply equipping schools with different forms of technology does not necessarily lead to new and innovative learning environments". While there is evidence, as revealed in this section, for the importance of having suitable access to technologies in the learning space, the literature has revealed other factors, such as educational system support and teachers' expertise, as important contributors to the ability of teachers to integrate ICT.

2.1.3 Educational system and school leadership support

In the literature reviewed, educational systems' organisation and support were commonly seen to influence teacher adoption and integration of ICT. Adoption is influenced by school leaders through a top-down model (Ertmer & Ottenbreit-Leftwich, 2013), and regardless of the usefulness or innovation of a technology, contextual factors can lead to non-adoption. These contextual factors, described in the literature, include those that are:

- systemic, e.g. policies
- administrative, e.g. budgeting, timetabling
- supportive, e.g. collegial
- attitudinal, from teachers and the community.

The importance of educational system and school leadership support was contested in the literature, especially at the class teacher level. Several studies found that this factor strongly influenced teachers' ability to integrate interactive technologies (e.g., Eikelmann et al., 2017; Hramiak & Boulton, 2013; Inan & Lowther, 2010), but Ritzhaupt et al. (2012) found that the factor did not rate as highly. Although this reveals some disagreement about the significance of its effect, educational system and school leadership support cannot be ignored as a factor.

At a systemic level, Moyle's (2015) study examined systemic organisation as a factor across three educational systems – in Hong Kong, Finland and Singapore. These systems rated highly on the Networked Readiness Index (NRI), and scored highly in the PISA, The International Mathematics and Science Study (TIMSS) or Progress in International Reading Literacy Study (PIRLS). A NRI is assigned to a country through an assessment of its use of ICT for economic purposes and the extent to which the country's government is willing to take advantage of ICT to improve their economic status (Milenkovic et al., 2016). While the three countries differed in policies and strategies, the support of schools in their use and integration of ICT was a priority in each case (Moyle, 2015). These countries worked to maintain or improve the level of ICT exposure and infrastructure in schools, and to build teacher capacity in using and integrating technology. This investment appears to have facilitated improved student outcomes, seen across the international standards-based tests. It also appears to have contributed to higher abilities in these countries to take advantage of technologies for productivity, as seen in the high NRI scores.

Other studies showed that school-based leadership greatly influenced the school culture affecting school-wide adoption and support of digital technologies. Teachers who showed a higher level of ICT adoption and integration were those who had higher access to technology, and were encouraged and supported in its use (Wang et al., 2014b). Similarly, school leaders have the potential to cascade down shared visions and common goals for positive ICT adoption (Eikelmann et al., 2017). Conversely, disinterest in the school leadership was more likely to result in unsuccessful culture change (Care & Griffin, 2014). Two studies reported that differing attitudes of school leaders resulted in inconsistent adoption and integration of ICT (Ertmer & Ottenbreit-Leftwich, 2013; Levin & Shrum, 2014).

Hardy et al. (2017), in their study in a Queensland school, saw that school leadership support of teacher development had positive results. In their study, the principal provided time for teachers to meet, discuss and reflect on their teaching practices. As a result of these organised and formal discussions and meetings, teachers were using the language from these organised events in their regular discourse with each other. These regular and informal conversations allowed teachers to engage in discussions that challenged their practices, their beliefs about students as learners and the purpose of their teaching (Hardy et al., 2017).

In contrast, school leadership can also have a detrimental effect on ICT adoption and integration. Hramiak and Boulton's (2013) study revolved around the teachers' use of weblogs (blogs) as part of their professional reflection. It contrasted the way blogs were used from when the teachers were pre-service teachers until after they were appointed to a position. The authors explained that the teachers were encouraged to use blogs as part of their learning reflection during their university studies. The reflections resulted in developing pedagogies and a growing number of teaching strategies. When the teachers commenced their appointment, the study reported that the teachers encountered barriers to their ongoing use of their blogs, which included a lack of support from school leaders, restrictive local policies and infrastructure that hindered the teachers' ability to access the blogs (Hramiak & Boulton, 2013). The study reported negative results as a consequence of these barriers, including reduced professional growth (Hramiak & Boulton, 2013).

The literature review found several studies (e.g., Audit Office of New South Wales, 2017; Blannin, 2015; Ng, 2016) that showed teachers needed time set aside to build capacity and confidence in using and integrating interactive technologies. An example is Prieto-Rodriguez's (2015) study on the low ICT adoption rate by mathematics teachers, revealed by the annual reviews of NSW's one-to-one laptop program conducted by the University of Wollongong (Howard & Mozejko, 2013; White 2014). The laptop program stemmed from the federal *Digital Education Revolution* program which aimed to improve schools' infrastructure, raise the profile of ICT, equalise students' and schools' advantage, add to available learning resources, and build teacher capacity (White, 2014). The application of this program in NSW can be seen in bulletins produced by the NSW Department of Education and Training (2009a, 2009b). The mathematics teachers in the study reported that one major factor for their non-adoption was the lack of time to explore and learn how to use the available technologies (Prieto-Rodriguez, 2015). Similarly in other studies, a lack of time to practise using the technologies for teaching and learning led to problems of technology integration, such as a lack of teacher confidence in using (Hramiak & Boulton, 2013) and reduced teacher adoption of (Lawrence & Tar, 2018) technologies for teaching and learning. DoE's policy states that such time, to be used to build confidence and expertise, can be allocated to teachers in public schools through the use of a school's operational funding (DoE, 2018f).

The literature in this section has revealed that educational system and school leadership support was necessary to allow teachers to successfully integrate interactive technologies, and to enhance students' learning experiences. Positive leadership support resulted in greater opportunities for students to achieve outcomes (Moyle, 2015) and in transforming teacher practice (Hardy et al., 2017). It appears that it is necessary to provide teachers with time to explore the use of available technologies, so that these technologies could be used effectively for teaching and learning (Lawrence & Tar, 2018). Conversely, lack of leadership support resulted in fewer opportunities for teachers to positively change their practices, and reduced their ability to build confidence when using the technologies available to them (Hramiak & Boulton, 2013).

2.1.4 Teacher expertise, confidence, attitudes and beliefs

The contribution of teachers' expertise, attitudes and beliefs was considered by several studies, such as Ertmer and Ottenbreit-Leftwich (2013), and Hramiak and Boulton (2013), to be important in influencing teachers' ability to integrate interactive technologies. Ertmer and Ottenbreit-Leftwich (2013), in particular, considered this factor more important than the other factors previously discussed. This section is organised by splitting this broad factor into three sub-factors – teachers' expertise and confidence, putting theory into practice, and teachers' attitudes and beliefs.

Teachers' expertise and confidence

As already indicated, interactive technologies in learning spaces do not necessarily add to teaching and learning experiences (Cotten et al., 2011; De Vita et al., 2014; Sweeney, 2013). Since the activities inside a classroom are determined by the teacher, the interaction with any technology is reliant on teacher decision, choice and permission (Beauchamp & Kennewell, 2018; Murcia, 2014; Suárez-Rodríguez et al., 2018). Gibson (1977) explained that every environment offers different affordances, without the need for anybody to interact with it. While, as mentioned in section 2.1.1, technology generally affords a number of benefits in education, different technologies will afford varying possibilities to teachers and students. These variations in learning environments and technologies, in combination with the fact that teachers need to make choices and decisions about the use of technology in their learning spaces, imply that focus needs to be on the individual teachers within their specific learning spaces. As mentioned by Brown (2005) and Gibson (1977), for an actor to take advantage of the affordances within their own environment, these affordances must first be perceived by that actor, including the identification of any potential to manipulate the affordances to the actor's advantage. For teachers to make the appropriate decisions and choices, therefore, teachers need to first be able to perceive the affordances available in their learning spaces, including those relating to technology integration. A change in perception would affect the actor's interactions with and behaviours within an environment (Gibson, 1977). This suggests that as teachers increase their expertise and knowledge of the potential for using the technology affordances in their learning spaces, they would change the way they act and interact with the technologies in these spaces. Gregorcic et al. (2017) found that experienced physics teachers with access to IWBs demonstrated high aptitude using the technical functionality of the IWBs, but their ability to integrate IWBs into more advanced pedagogical and student-centred learning was limited. While these teachers had a willingness to explore more complex use of the IWB, they struggled to find opportunities to develop skills and confidence in doing so (Gregorcic et al., 2018). Gregorcic et al.'s (2018) study indicates the need for teacher knowledge and practice to afford opportunities for successful integration of ICT, and this need can be similarly found in other studies (e.g., Beauchamp & Parkinson, 2008; Hurd, 2009). These studies provide evidence that teachers' expertise in integrating technologies remains varied.

Kennewell et al. (2008) study of IWB use in British schools showed teachers were attracted to IWBs because they offered a consolidated repository of digital tools. However, the tools teachers were attracted to did not always improve the learning experiences for students (Kennewell et al., 2008). As Gibson (1977) explained, misconceived perceptions of an environment's or an object's affordances can act negatively on the actor, meaning that they may not be accessing these affordances in the right way. Studies (e.g., Chamblee, 2013; Gregorcic et al., 2018; Kennewell et al., 2008; Sweeney, 2013) found that, in many cases, IWB tools reinforced a teacher-centred approach to teaching and learning, and that teaching practices did not change. Schools often equate teachers' extensive use of technology as expert use in an educational context (Mercer et al., 2010). While those teachers who are more adept at using ICT for other purposes, such as administration, find it easier to integrate the same skills into teaching and learning (Padmavathi, 2017), expertise in technology cannot be equated to expert integration (Albion et al., 2015). Similarly, while both technological and pedagogical competencies were considered as predictors for ICT use in class, Suárez-Rodríguez et al. (2018) found no relationship between the technological competencies and such use of ICT. The measure for expert integration should be considered by its impact on teaching and learning experiences (Aflalo et al., 2018; Chamblee, 2013; Cotten et al., 2011).

There is an expectation that teachers show an ability to effectively integrate technologies into teaching and learning. As stated in Chapter 1, there is an expectation of ICT integration in the teaching standards at the Proficient level (AITSL, 2017a; NESA, 2014). Similarly, this expectation is also reflected, to varying degrees, across the standards at Graduate, Highly Accomplished and Lead levels. The national standards require teachers to be able to successfully integrate ICT into teaching and learning programs. Despite this expectation, the research described in this section argued that teachers' technical skills have not always transferred into a more integrative and student-centred approach to teaching and learning. In order to meet this expectation, teachers should be given opportunities to develop their knowledge and skills (Haydn, 2014).

From theory to practice

Some studies have suggested that ICT integration, or lack thereof, may not be evidence for teachers' lack of knowledge or poor attitude towards the use of ICT in learning spaces. Examples include Ng (2016) and Blannin (2015), who reported that teachers in their studies were able to speak positively of ICT use and its integration into their pedagogy, but were not always able to demonstrate expert integration. While there are studies that suggest knowledge and skills are directly interrelated (e.g., Kraft et al., 2016), others, such as Ng (2016), suggest there is a greater number of factors that influence teachers' willingness to integrate interactive technologies. Table 2.1 provides an overview of the literature that notes the complexities of teachers' ability to integrate interactive technologies and categorises these complexities by systemic influences (such as by school or system leadership), the teachers' skills or their attitudes.

Table 2.1

List of complexities influencing the bridge between theory and practice

Literature	Systemic, skills or attitudes	Complexities
Ng (2016)	Systemic	External motivations (e.g., monetary rewards presented to the teacher for having high achieving students)
Blannin (2015)	Systemic	External pressures of students' achievement in standardised testing, such as the National Assessment Program for Literacy and Numeracy (NAPLAN)
Prieto-Rodriguez (2015)	Systemic	A lack of resources
Kennewell et al. (2008)	Systemic	Lack of time to allow teachers to 'play' with devices and build confidence in their use
Lawrence & Tar (2018)	Systemic & Skills	Leadership support in motivating teachers to adopt and integrate technology, including support in overcoming apprehension and resistance
Albion et al. (2015)	Skills	Teacher skill and knowledge, including making judgements about the technology for teaching and learning
Gray et al. (2007)	Skills & Attitudes	Teachers' lack of confidence and ability to remedy issues affects teachers' willingness to hand over control of expensive ICT devices to students
Ng (2016)	Attitudes	Teachers' consideration of ICT use and integration during learning design

Literature	Systemic, skills or attitudes	Complexities
Howard (2013)	Attitudes	Teachers' lack of value in integrating ICT, which supports and influences established beliefs that ICT has little value for teaching and learning
Blannin (2015)	Attitudes	Lack of successful integration of ICT yields a lack of confidence, negative attitudes towards ICT in teaching and learning, and reduced willingness to take risks

Although mention of systemic influences and expertise has already been reported, the literature in Table 2.1 focuses on the complexities that affect teachers' abilities to put knowledge into practice, and those that affect teachers' attitudes towards integrating ICT for teaching and learning. The table also shows that some complexities are beyond teachers' control, further emphasising the need for educational system and leadership support, as well as support from other agents, to ensure teachers' abilities to demonstrate their skills and knowledge. While the complexities in Table 2.1 are broadly categorised into systemic, skills and attitudes, it is important to consider these complexities both holistically, to reveal the interactions between these categories, and independently, to highlight the nuances which are unique to each complexity. As both teachers' expertise and skills, and educational system and school leadership have already been examined independently, it is, therefore, appropriate to examine those factors relating to teachers' attitudes to and beliefs about ICT integration as well.

Teachers' attitude and beliefs

Successful integration of ICT in teaching and learning is influenced by teachers' positive beliefs about and attitudes towards its use in learning (e.g., Coleman et al., 2016; King, 2014; Lawrence & Tar, 2018; Sang et al., 2010). A teacher's positive attitudes can result in personal empowerment, which can lead to increased personal ability (King, 2014). In fact, there is a direct interrelationship between attitudes and efficacy, confidence, and sustainability of new practices learnt (King, 2014). It can be assumed that this would relate to skills learnt for the use and integration of ICT. Conversely, other studies (e.g., Adnan & Tondeur, 2018) found that negative attitudes towards ICT can be a barrier towards successful ICT integration. Of the factors that influence integration, mastery and teacher attitude and readiness are strong influences (Inan & Lowther, 2010). In particular, it was considered that teacher attitudes and beliefs are strong enough to mitigate barriers from other factors (Ertmer & Ottenbreit-Leftwich, 2013).

One study reported a relationship between positive attitudes towards the use of technology, and teacher pedagogies and expectations as a whole (Orlando, 2014). An example from the study showed a teacher's expectation of her students increased as she witnessed increased student abilities through the use of ICT. Other studies showed that teachers' more positive attitudes towards ICT resulted in greater success (Whitworth & Chiu, 2015) and more willingness to take risks, innovate and adopt changes (Howard, 2013; Sang et al., 2010).

Conversely, lack of confidence, computer anxiety, and negative attitudes and beliefs about ICT can be barriers for teachers when integrating interactive technologies (Coleman et al., 2016; Gibson et al., 2014; Howard, 2013). Studies, such as Cotten et al. (2011) and Gibson et al. (2014), suggested that increased exposure resulted in increased anxiety. However, the authors suggested the apparently increased anxiety might be attributed to existing anxiety being more noticeable due to increased teacher awareness. The research appears to suggest that overcoming computer anxiety relies on teachers having more skills with, and greater confidence in, integrating ICT (Gibson et al., 2014; Shah et al., 2012).

The research (e.g., Howard, 2013; Murphy, 2016; Ng, 2016) also suggests that successful integration is reliant on teachers' beliefs that the technology has value for improving student outcomes and has relevance in practice. In fact, a belief that ICT supports learning is a critical factor for the realisation of ICT integration (Howard, 2013). Positive experiences when integrating ICT contribute to a teacher's belief in the benefits of ICT integration (Howard, 2013), but the risk is that when teachers encounter failures, these experiences can contribute to negative attitudes towards ICT use.

Overall, this section described factors found in the literature that appear to affect teachers' ability to successfully integrate technologies into teaching and learning. Firstly, while some literature reported that access to technologies remained a problem, others have suggested that access does not necessarily impact on teachers' use of technologies and on students' learning experiences. Also, the literature emphasised that teachers' ability to integrate technologies can be affected by systemic and school leadership, and by the teachers' own skills in and attitudes towards the use of such technologies for teaching and learning. The implication is that interventions need to be implemented to facilitate such change in teachers' skills and attitudes. Prestridge (2014) suggested professional learning as a way to both build capacity and to challenge beliefs. Therefore, the following section will explore professional learning as a way to build teacher capacity.

2.2 Facilitating capacity building

As stated in the previous section, it appears that teachers' professional learning could offer a solution to increase teacher expertise in and develop more positive dispositions towards integrating technologies. This would not only build teachers' skills and confidence, but also ensure teachers have the ability to eliminate or reduce the number of problems they encounter during technology integration.

This thesis adopts the definition of professional learning used in the *Australian Charter for the Professional Learning of Teachers and School Leaders*, which states:

> Professional learning is the formal or informal learning experiences undertaken by teachers and school leaders that improve their individual professional practice, and a school's collective effectiveness, as measured by improved student learning, engagement with learning and wellbeing. At its most effective, professional learning develops individual and collective capacity across the teaching profession to address current and future challenges.
>
> (p. 2, AITSL, 2012)

This definition of professional learning, as clearly articulated in the first sentence of the quotation, is not restrictive to any particular form of professional learning activity, but rather addresses a teacher's learning needs contextually, in order to enhance student learning, engagement and wellbeing.

This focus on professional learning to target student outcomes is supported by studies that suggest that the ultimate goal for a teacher's work is the improvement of student outcomes (King, 2014; Kraft et al., 2016) and that students' achievement will not shift without changes in teachers' knowledge or practices (Kraft et al., 2016). Professional learning is considered by many studies (such as Aubusson et al., 2015; Barrera-Pedemonte, 2016; Stewart, 2014) to be an effective strategy for increasing teachers' skills and changing teachers' attitudes. In particular, a number of studies have highlighted the need for professional learning to build teachers' capacity when implementing integrative practices (e.g., Albion et al., 2015; Pietro-Rodriguez, 2015; Wang et al., 2014b).

Despite this imperative to build teacher capacity and change teachers' practice, it is unfortunate that the direction of professional learning in many schools is often administrative, such as compulsory professional learning for compliance, and has little focus on improving student learning (Care & Griffin, 2014). This is in the face of an assertion from an earlier study that all teachers' professional learning implicitly aims to target student outcomes (Clarke & Hollingsworth, 2002). Shifting the focus of professional learning towards learning and teaching will facilitate placing teachers in stronger positions to affect student achievement (Prestridge, 2014; Whitworth & Chiu, 2015).

The need to shift the focus of professional learning is further supported by an examination of measures for effective professional learning. One such measure is the *Kirkpatrick Model* (Kirkpatrick Partners, 2019), first published in 1993, which evaluates participants' behaviours following their participation in professional learning, from initial reaction to seeing the expected outcomes of the training. The *Kirkpatrick Model* suggests that effective professional learning should result in participants' behavioural changes, which would lead to improved organisational performance. Relating this to an educational context, Guskey's model, derived from the *Kirkpatrick Model*, shows that the highest level of impact for any teachers' professional learning should be on changes to student outcomes (Guskey, 2002; Kreider & Bouffard, 2006). Guskey (2000) suggested that a focus on student achievement when designing teachers' professional learning would ensure more relevant impact of the professional learning by providing clarity to its purpose.

Despite the assertions from some of the studies above that teachers' professional learning directly impacts on student outcomes, other studies (e.g., King, 2014; Talbot, 2016; Toom, 2016) propose there are contributing factors that can affect the success of teachers' learning on student achievement. Factors such as motivation, and professional learning design, focus and mode can impact on the effectiveness of professional learning activities. As part of the critical review, features of mentoring were also examined. In the literature about mentoring and coaching, common features of successful professional learning design appeared to coincide with features of mentoring. There are, of course, caveats in assuming mentoring is the only solution needed in the area of professional development and learning for integrating interactive technologies. Therefore, the following sections will explore the aspects of professional learning that yield greater success, and features that facilitate effective mentoring.

2.2.1 Factors influencing professional learning and performance development

The review of literature showed that there were common factors and features in professional learning designs which led to greater success. Examining current models of effective professional learning design showed that utilising combinations of recognisable professional learning characteristics, rather than creating new ones, was highly effective. These included: motivation, learning design and focus, online and digital tools, individualisation of learning, collaborative professional learning, reflection and transference, and duration.

Teacher motivation

Teachers' motivation affects teachers' participation and engagement with professional learning activities. Teachers may be motivated by potential salary increase, accreditation, career progression, and gaining new skills and knowledge (Whitworth & Chiu, 2015). However, the most effective motivator appeared to be the motivation to learn, to gain new skills or knowledge, followed by achieving a higher level of teacher accreditation and improving the chance of positive career moves (Whitworth & Chiu, 2015). An example from Orlando's (2014) study was a teacher who found that she was required to learn how to integrate ICT because of changes to the curriculum. As a result, this teacher participated in professional learning to develop new skills. This, Orlando (2014) argued, showed the causal effect of motivation on professional development.

This factor suggests that the effectiveness in professional learning focused upon integrating ICT will depend on participants' motivation prior to engaging with the learning. Consequently, rather than mandating any professional learning, an improvement in teachers' learning outcomes is more likely to occur when participants are motivated to participate and see value in the learning.

Professional learning design and focus

Another feature that influences professional learning's success is its design and focus. A well-designed professional learning activity can influence change to practice and beliefs, while a poorly designed professional learning experience can yield negative results (AITSL, 2014). More than 75% of the respondents to the TALIS 2018 reported that they considered effective professional learning to have a coherent structure (OECD, 2019a). The success of any professional learning is ultimately reliant on the participants (AITSL, 2014) and, therefore, professional learning design should consider the participants' preferences and the value they place upon particular learning strategies. Teachers tended to value conducting their own research most highly, followed by mentoring and networking (Hadley et al., 2015). The least-valued form of professional learning was doing professional reading, including book chapters and peer-reviewed journals, followed by, as second lowest, undertaking formal training. Other design factors contributing to successful professional learning, revealed in other studies, included learning that is ongoing, embedded into participants' jobs and contexts (Albion et al., 2015; Audit Office of New South Wales, 2017; OECD, 2019a), and supported by leaders and colleagues (Gore et al., 2016).

Furthermore, when designing professional learning, consideration should be given to the content and focus of the activity. Professional learning has been used to develop teachers' competencies in integrating interactive technologies and has been considered worldwide as a determining factor for success in using interactive technologies for teaching and learning (Eikelmann et al., 2017). Orlando (2014) conceded that the example in her study did not conceptualise what is generally considered as integration mastery, as the teacher did not have sufficient focus for the professional learning. The result was that the professional learning was not as effective as it could have been. Similarly, in other cases, professional learning offered in the area of technology integration did not focus on the application of technology in teaching and learning, but rather on the functionalities of technologies (Eikelmann et al., 2017). This was inadequate, as issues of pedagogies are more important than learning how to use a technology (Prestridge, 2014). These studies provide compelling reasons for due consideration to be made when designing professional learning. It is essential to consider both the most appropriate activities to the participants and that the content meets the needs of the learners.

Online and digital tools for professional learning and performance development

Online and digital platforms, such as social media, were not highly regarded by many organisations as they found it difficult to harness online practices and resources for systemic and organisational goals (Goddard et al., 2014). Also, AITSL (2014) stated that online professional learning could result in certain limitations, including participant misuse, disconnection with and lack of support, and limited links with and support for practical application.

Despite these limitations, there are benefits of learning through digital technologies which reflect features of successful professional learning and, therefore, this form of learning can be considered when designing professional learning. These features include:

- the presenter or designer personalising learning for the participants
- collaboration between participants
- ease of access, especially flexibility of learning availability

- a repository of support materials
- a multimodal delivery of learning (AITSL, 2014).

Individualising professional learning and performance development

A compelling reason to provide a targeted approach to professional learning in this area is that many students in Australia are not experiencing equitable ICT-related teaching and learning (Jamieson-Proctor, 2018). One feature of effective professional learning and development, which further supports this approach, is a need for a clear understanding of how the learning content can relate to the participants' learning needs and context (AITSL, 2014; Jensen et al., 2016; Whitworth & Chiu, 2015). Teachers value contextualised professional learning highly (Aubusson et al., 2015; OECD, 2019a) as it provides greater relevance; allows peer learning from those who understand the contextual factors; takes advantage of existing support mechanisms (Albion et al., 2015; Youngs, 2013); is flexible enough to address changing needs and the participants' choices (AITSL, 2014; Goddard et al., 2014); and allows point-in-time support (Aubusson et al., 2015). The conditions of location and context influence the effects of professional learning and may facilitate the connection between the content and application (AITSL, 2014; Mansfield & Thompson, 2017). These conditions may include school leadership support, access to resources and understanding of participants' prior knowledge. Disconnection between professional learning and learning application over a long period of time has resulted in schools and teachers being resistant to professional learning (Mansfield & Thompson, 2017). Helping teachers make connections between the learning and its application is likely to improve teachers' perception of professional development and learning, and this improved perception would facilitate a renewal of teaching practices (Mansfield & Thompson, 2017). This is especially important, when considering that teachers considered opportunities to apply new learning, ideas and strategies in their own learning spaces as a characteristic of effective professional development (OECD, 2019a).

Collaborative professional development and learning

Another feature of successful professional learning is collaboration. Collaboration, for the purpose of this review, is defined as a situation where individuals work together to identify and explore a problem, and where these people can collectively determine a solution that would be beyond the vision of any individual (AITSL, 2017b; Gray, 1989; Roschelle & Teasley, 1995). Collaborative professional learning is powerful in renewing and refreshing professional practice, and has strengths in sustainability and development (Hardy et al., 2017). In Bridwell-Mitchell's (2015) study of collaborative professional development in schools with high numbers of student behaviour issues, teachers collectively changed their attitudes and focused on solutions rather than the problems. The normalisation of shared practices and development of collective attitudes, aims and beliefs saw teachers increase their confidence in their teaching, which resulted in positive student responses (Bridwell-Mitchell, 2015). A collective and joint school culture for professional change creates an environment that encourages teachers to discuss, work and learn together, while applying new learning to their practices (Aubusson et al., 2015; King, 2014; Whitworth & Chiu, 2015). This culture can result in improved teacher efficacy and commitment to change (Mansfield & Thompson, 2017).

Professional learning that includes aspects of collaboration allows for discussions about areas of shared concerns (Hardy et al., 2017), and provides support for the development and implementation of new skills and practices (Care & Griffin, 2014; Dogan et al., 2016). These benefits, however, can only be realised when teachers share goals and aims for their professional learning. Bridwell-Mitchell (2015) explained that problems would arise if teachers 'pull' in different directions.

With joint goals and directions, teachers are more likely to become collaborative in their learning. While teachers did not often engage with collaborative learning intentionally, the collaborative nature of the learning was naturally occurring when teachers sought to sustain their learning (King, 2014). This was reinforced by Aubusson et al. (2015), who reported that 93% of their participants wanted to be part of professional learning that facilitated sharing and collaborative professional discussions. Such sharing and discussions allowed teachers to pool ideas, reflect on classroom experiences and discuss possible future strategies to cater for student learning needs (Aubusson et al., 2015; Care & Griffin, 2014). The TALIS 2013 returned positive ratings of 86% for professional learning that featured shared preparation, execution and reflection (Barrera-Pedemonte, 2016). Similarly, the TALIS 2018 returned positive ratings of over 70% for professional development that provided opportunities for collaborative learning (OECD, 2019a). Given the value that teachers place on collaborative learning, it was surprising to see that under half of Australian teachers (approximately 40%) attended professional learning in a school team and an even smaller number of Australian teachers (approximately 25%) participated in any form of collaborative learning (Barrera-Pedemonte, 2016). It appears that when designing professional learning for teachers, the learning should provide opportunities for collaboration, allowing the participants to build collective efficacy and to sustain their learning.

Reflection and transference

Another characteristic of effective professional development and learning identified in the literature was reflection. Reflection allows teachers to challenge and transform their attitudes towards and practices in teaching (Prestridge, 2014; Toom, 2016). Wang et al.'s (2014b) study showed that reflection is a key and vital feature for professional learning. They found teachers took greater ownership of their learning, technology and resources, which resulted in increased teacher confidence in integrating ICT. In addition, teachers who were provided with reflection time were able to drive and contextualise their learning to address their professional learning needs, as well as the needs of their students (Carter et al., 2016).

Similarly, Prestridge's (2014) study reported that blogging, as a reflective strategy, allowed her participants to develop greater understanding of their work, and saw increased improvement in their teaching effectiveness. Those teachers who reported negative responses in Prestridge's (2014) study were primarily those who had limited experience of reflection or little support in how to effectively reflect. The teachers found that blogging allowed for critical analysis of practices, resulting in deeper understanding of pedagogy and changes in thinking, practice and student learning (Prestridge, 2014).

In another study, teachers did not have the time to reflect on their professional learning, as the requirements of the course exceeded the teachers' available time (Andrade & Coutinho, 2019). The problem was compounded by the fact that the teachers needed to commit time to develop the necessary skills and knowledge before being able to access the professional learning. As a result, the teachers were not able to fully engage with and consider the content of the course (Andrade & Coutinho, 2019).

These examples suggest that reflection, and time to do so, is necessary for teachers to fully take advantage of any professional learning. It is important for the teacher to understand and acknowledge the quality, effectiveness and impact of their professional learning, in order to apply the learning to their needs, and the needs of their students (Toom, 2016).

A feature that stems from reflection is transference. Transference is the application and implementation of the content learnt through professional learning (AITSL, 2014). As previously stated, the responses to the TALIS 2018 showed that teachers value opportunities to apply new ideas and knowledge into their own teaching and learning spaces (OECD, 2019a). It is, therefore, important to consider strategies which can support teachers in transferring their learning into their own context. When designing professional learning, factoring in self-reflection and feedback from peers can facilitate the transference of new skills and knowledge into the teacher's own context. Reflection can sustain successful transference by providing the practitioner with the ability and opportunity to understand theory, assess the impact of professional learning in context, and make decisions about future learning needs (AITSL, 2014).

Duration of the learning

Studies (e.g., Ernst & Erickson, 2018; Hramiak & Boulton, 2013; Whitworth & Chiu, 2015) have found that professional learning was more effective when the courses were prolonged, ongoing and continuous. These studies reported that professional learning which had longer duration and was spread over time, tended to include more active participation, was more content-focused, and had coherence between teachers' context, needs and the focus of the professional learning. These, the studies argued, were factors that positively affected the effectiveness of professional learning. In particular, Wang et al. (2014b) emphasised that time is required for teachers to master technology skills.

For example, two studies showed that positive effects of a professional learning activity were only evident after prolonged periods. The first example was Whitworth and Chiu's (2015) study, which could only report positive effects after the second year. The second study found that the long contact hours with the participants allowed for a more comprehensive approach, which meant that the participants could focus on their learning needs, learn new strategies and implement them into their own teaching practices (Wang et al., 2014b).

Despite this apparent need for prolonged exposure to professional learning, the report on TALIS 2013 showed that Australian teachers tend to participate in short-term, traditional forms of professional learning (Barrera-Pedemonte, 2016), such as attending courses and workshops which are often less effective (AITSL, 2014; Mansfield & Thompson, 2017). Such half-day and full-day courses prioritised transmission of information, in the hope that the information would be transferred into the participants' practices (Mansfield & Thompson, 2017). The studies in this section suggest that professional learning that has more impact on changing teacher practice would require sustained engagement with the learning.

2.2.2 Features of successful mentoring

Mentoring as an effective professional development and learning strategy was suggested by NSW teachers in consultation with the LSLD reform (NSW Department of Education and Communities, 2012). Mentoring is characterised as a combination of activities, discourses and relationships (Kemmis et al., 2014) with the purpose of developing teaching pedagogy, and which provides information, advice, professional learning, and emotional and social support (Maor & McConney, 2015). To consider the implication of mentoring for the professional learning model designed for this study, literature regarding mentoring was examined. This examination revealed three key areas of note.

First, the literature showed that mentoring is often aligned with the development of early career teachers (such as seen in Hudson & Hudson, 2016; Maor & McConney, 2015; Schuck et al., 2017). However, it can be argued that mentoring can be an effective professional learning tool for any teachers at any stage of their profession (Nolan et al., 2013).

The second area of note is that it appears from the review that coaching and mentoring share similar features and that the differences between them are minor. Hay Group (2013) showed that mentoring processes cross over with different types of coaching and that those aspects that Hay Group (2013) distinguished as differences appear very similar. The differences between mentoring and coaching, and their common features are outlined in Table 2.2. Some features in mentoring may appear to be duplicated multiple times, however these are repeated to show that these features are comparable to those listed in the coaching column.

Table 2.2

Comparison of features of mentoring and coaching

Common features
▪ Modelling, observing and articulating practice ▪ Shared planning ▪ Encouraging experimentation ▪ Highlighting evidence from research and others' practice ▪ Establishing confidence in the relationship ▪ Listening ▪ Asking good questions ▪ Reviewing and action planning

Comparative features	
Coaching	Mentoring
▪ Providing support to clarify and refine goals	▪ Identifying learning goals
▪ Reflecting on and debriefing shared experiences	▪ Highlighting evidence from research and others' practice
▪ Sharing and analysing evidence from others' practice	▪ Assessing, appraising or accrediting practice
▪ Understanding each other's learning goals	▪ Supporting progression
▪ Planning supported by questions	▪ Providing guidance, feedback and direction
▪ Experimenting	▪ Reviewing and action planning
▪ Drawing on evidence from research and others' practice	▪ Highlighting evidence from research and others' practice

(derived from Hay Group, 2013, p. 8)

This evidence of the similarities between mentoring and coaching allows for the assumption that the value of coaching can be easily applied to mentoring and vice versa. While this section only refers to 'mentoring', in fact it describes factors that lead to successful mentoring and coaching.

While reviewing the relevant literature, a set of 'best practices' emerged for mentoring. In fact, poorly implemented mentoring can result in negative effects (Schuck et al., 2017). The final area of note is that some of the features of successful mentoring appear to align with features of effective professional learning. Therefore, this section will first summarise those coinciding features, followed by those features that are unique to mentoring.

Features of mentoring that align with effective professional learning

The features that emerged as consistent between effective professional learning and mentoring include:

- the individualisation of learning
- the inclusion of collaboration in mentoring
- an allowance for learner reflection
- a prolonged exposure with the learning.

Individualisation of learning. Mentoring provides a way to tailor and individualise professional learning (Nolan et al., 2013) and allows learning from peers with contextual knowledge (Burke et al., 2015; Nolan et al., 2013). Considering that many teachers considered contextualised professional learning as valuable (Aubusson et al., 2015; OECD, 2019a), the literature presented three notable strengths of mentoring in relation to contextual knowledge. Firstly, the mentor and the mentee share understanding of contextual factors, and its attributing enablers and barriers (Hramiak & Boulton, 2013; Kemmis et al., 2014). Secondly, the mentor and mentee already having established professional trust, which supports deeper engagement with the learning process (Mansfield & Thompson, 2017). Finally, sharing the same context means that the mentoring partners share similar goals, more readily than mentoring partners in different settings (Kemmis et al., 2014).

Collaborative professional learning. Mentoring in schools exhibits features of collaborative learning, as it allows for:

- the identification of areas of possible growth and negotiation of possible strategies to address these areas. This is in line with the definition of collaboration by Gray (1989), and Roschelle and Teasley (1995), where there is a collective identification of a problem, or an area for improvement, and solution. Mentoring provides opportunities for the mentor and the mentee to share ownership of professional learning goals (AITSL, 2017b).

- a balance of power between the mentor and mentee (Hudson & Hudson, 2016; Kemmis et al., 2014). This will be discussed in more detail later in this section.
- the discussion and analysis of current teaching practices, leading to an increased understanding of how new practices can play out in learning spaces (AITSL, 2017b; Nolan et al., 2013).

Similar to other collaborative professional learning, as considered in section 2.2.1, mentees may feel more supported and develop increased confidence in their teaching, as mentoring provides opportunities to share ideas and resources (Schuck et al., 2017). As mentoring can remove feelings of isolation, especially for those working in rural and remote areas (Kemmis et al., 2014; Nolan et al., 2013), there are arguments that mentoring can be aptly applied in a virtual environment, increasing scope and scale, and improving the individualisation of the mentoring (Kraft et al., 2016). However, the structure of mentoring still needs to be clearly defined and restricted, as scope and scale can affect teachers' buy-in attitudes and comfort, and will, therefore, impact on the effectiveness of the mentoring and learning process (Audit Office of New South Wales, 2017; Kraft et al., 2016).

Reflection on teaching practice. Mentoring is inextricably linked with reflective practice. One of the benefits of mentoring is that the mentor provides guidance to collaboratively assess and reflect on the mentee's practices and actions. Mentoring engages the participants in reflective practices that foster professional growth (Nolan et al., 2013). The mentor plays a key role in guiding the mentee to set goals and reflect on their practices, as well as being a model for the mentee (Hudson & Hudson, 2016). Mentoring also allows mentors to assess and reflect on the needs of their mentees, and to provide advice on designing and acting on individualised strategies (Hudson & Hudson, 2016).

Unique features of successful mentoring

Other than those features that align with effective professional learning, some common factors that appear to facilitate mentoring success emerged from the literature. These factors are organised by those that are relevant to the mentor, and then those that are relevant to the mentor and mentee relationship.

The mentor. The selection of the 'right' mentor is important and several criteria need to be considered when selecting a potential mentor. Kraft et al. (2016) explained that, when considering mentoring effectiveness, the quality of the mentoring is a more important factor than others, such as hours of contact. Specifically, the research, as seen below, suggests that mentors have to be motivated, have high collaborative and interpersonal skills, and be supportive and encouraging.

Motivation can be a drive for effective mentoring (Maor & McConney, 2015). In their study, Maor and McConney (2015) found that the majority of the mentors were primarily motivated by altruism. The mentors wanted to retain teachers in the profession, and provide them with the best possible support. It was also an opportunity for mentors to pass on their expertise to another generation of teachers. These mentors reported they were influenced by some personal motivation. Motivators included mentoring as a tool for self-reflection for mentors, opportunities for their own professional development and providing them with skills that would assist with future career goals. While an effective mentor should be motivated by altruism, most mentors were motivated by a combination of altruistic and personal motivators (Maor & McConney, 2015).

Other than being experts in mentoring and in content knowledge, mentors also need strong interpersonal skills to support the mentee's emotional and personal needs (Garbacz et al., 2015; Hay Group, 2013; Maor & McConney, 2015). These interpersonal skills include an ability to listen, support, show empathy and be trustworthy (Garbacz et al., 2015). Also, mentors need the ability to work collaboratively with their mentee and to be able to facilitate a shift towards mutually beneficial goals (Garbacz et al., 2015).

Mentors were not expected to have mastery of all the skills necessary to lead effective mentoring. It was suggested that mentors need ongoing training, support and resources to facilitate effective mentoring (Maor & McConney, 2015; Nolan et al., 2013). A possible strategy to support mentors is to provide them with their own mentors (Garbacz et al., 2015; Hudson & Hudson, 2016). Regardless of whether a mentor has access to formalised support and development activities, being part of a mentoring process provides the mentor, as well as the mentee, with benefits. Mentoring actions build on the mentor's experience and increases their effectiveness in mentoring (Hudson & Hudson, 2016).

Mentor and mentee relationship. The mentor and mentee relationship is crucial to a functioning mentoring structure (Hudson & Hudson, 2016). A healthy mentoring structure provides a balance of power between the mentor and mentee, allowing open communication and collaborative decision making (Hudson & Hudson, 2016; Kemmis et al., 2014). Healthy mentoring relies on a rapport between the participants, mutual acknowledgement of expertise and professional respect (Hudson & Hudson, 2016). Healthy mentoring emphasises the mentee's strengths and has a shared goal of building on these strengths (Schuck et al., 2017). An unhealthy mentoring structure, or one where mentoring has been unsuccessful, results in negative and demoralising experiences. Schuck et al. (2017) summarised an example where the mentee felt unsupported by their mentor and school leadership. The mentee lost confidence and was frustrated with their own progress.

The mentor has the primary responsibility to maintain a healthy mentoring relationship (Maor & McConney, 2015). Maor and McConney (2015) reported that mentors in their study felt that they facilitated the relationship and that they needed to focus on being active listeners, who were friendly, available, approachable and caring. On the other hand, Maor and McConney's (2015) mentors also reported that they found greater success in mentoring when their mentees were enthusiastic, open to accepting advice and willing to seek assistance.

2.3 Developmental frameworks for integrating technologies

To provide a target for the professional learning and mentoring, a definition of successful technology integration needs to be established. As indicated in the introduction, research studies have investigated the effective use of interactive technologies since their introduction as learning tools (e.g., Bai et al., 2016; Koh et al., 2017; Suárez-Rodríguez et al., 2018). Such studies have delineated the technologies' inherent functions, such as colourful graphics, and emphasised that mastery in integrating technology has the integral purpose of using the technologies to enhance student learning (Beauchamp & Parkinson, 2008; Hurd, 2009; Padmavathi, 2017). It is an issue that there are varying expectations of ICT integration across schools (Mercer et al., 2010), and emerging from studies on technology integration were different models and frameworks that attempted to define and explain integration mastery. In order to develop a suitable framework to support the professional learning in this study, existing frameworks and models needed to be examined for their structure and content. Studies that support or criticise these frameworks and models would also need to be examined, as these would highlight features that should be adopted or avoided. A variety of frameworks and models were considered, such as Bloom's digital taxonomy (Churches, 2008) and the International Society of Technology in Education's (ISTE) Standards for

Educators (ISTE, 2017) and Education Leaders (ISTE, 2018)[1], with the following chosen to be reviewed for their common use and structure.

The TPACK Framework (Koehler, 2017; Mishra & Koehler, 2006) and the SAMR Model (Puentedura, 2006) were cited in the literature as the most commonly used. Beauchamp's (2004) and Sweeney's (2008) interactive whiteboard-specific frameworks were also examined, as they provided defined indicators of skills and knowledge progression. The components and principles existing in these frameworks provided a benchmark for making judgements against factors contributing to teacher ability when integrating interactive technologies, as well as providing the basis for the framework used in this study.

2.3.1 The TPACK Framework

The TPACK Framework is used in a number of studies (e.g., Joo et al., 2018; Niess et al., 2009; Olofson et al., 2016) to address teacher capability in terms of teaching and learning (Padmavathi, 2017). The framework stemmed from the work of Shulman (1986), who argued at the time that there was a disconnection between the content and the pedagogy in teaching. He explained that Pedagogical Content Knowledge (PCK) is the conversion of the subject matter for teaching, requiring the teacher to have the skills to present the content to students through a variety of different means. The concept of PCK was explored in its application in initial teacher education programs and professional learning opportunities in order to build teacher capacity in attaining PCK (Niess, 2011). As technology was introduced into teaching and learning, teachers recognised that there needed to be a shift to acknowledge the specific affordances provided by technologies to affect students' thinking, the content

[1] The ISTE Standards mentioned here are updated versions of the superseded Standards-T (ISTE, 2008) and Standards-TL (ISTE, 2001), which were originally considered when choosing integration frameworks to be reviewed.

of lessons and the accompanying pedagogies (Niess, 2011). This recognition both affirms the need for teachers to perceive and leverage technologies' affordances to complement their teaching practices, as discussed in section 2.1.1, and resulted in researchers questioning the place of technologies in education, specifically about how to prepare both pre- and in- service teachers to adopt technologies into their teaching. Building on Shulman's (1986) concept of PCK, a new framework named TPCK was envisioned, which recognised that the 'whole teacher package' required teacher knowledge regarding teaching with technologies (Niess, 2011). The TPCK framework was designed to represent the intersections between pedagogy, content and technology. As the acronym was difficult to say and remember, the TPCK acronym was updated in 2007 to TPACK to avoid these problems (Niess, 2011). Various models were developed to represent TPACK, such as seen in Figure 2.1. These variations stem from the complexity of PCK, where the pedagogical-content knowledge domain may include various factors, such as curriculum, learners and schools (Niess, 2011). These complexities continued to exist, as scholars worked to adapt PCK into TPACK. Such complexities were compounded by issues such as defining the terms 'technology' and 'pedagogy'. For example, in the case of the latter, Niess (2011) explained the term 'teaching and learning' would better represent the scope of these actions, than the term 'pedagogy'. Another example would be whether the growth of a teacher's TPACK is representative of their growth in PCK (Niess, 2011). To address such complexities, various educational research directions emerged. However, studies in these directions tended to reveal even more complexities (Mishra & Koehler, 2006).

Despite these complexities in understanding the TPACK Framework and its application in teaching, it is generally recognised that the TPACK Framework represents the knowledge needed by teachers to support students' learning (Koehler, 2017; Mishra & Koehler, 2006; Niess, 2011). For this reason, the framework is particularly useful when considering integration and professional development in this area, as it provides a benchmark for comparing teachers' current practices with practices recommended by the various studies that have explored the application of TPACK (e.g. Koehler, 2017; Mishra & Koehler, 2006). The framework was designed using three independent components, which cross over to establish another four blended components. This is shown in Figure 2.1.

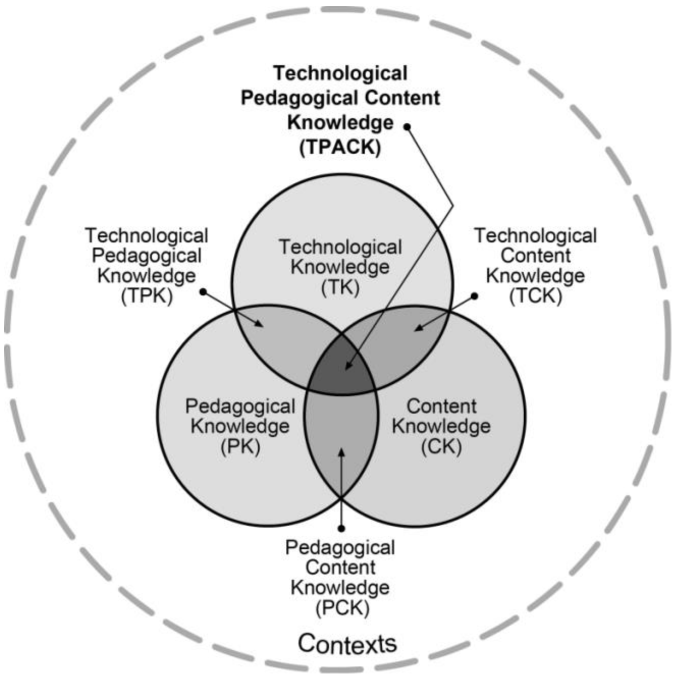


Figure 2.1. The TPACK Framework

Technological Knowledge. Technological Knowledge (TK) is about technology and working with it (Koehler, 2017). While TK is developed for one piece or type of technology, this knowledge can be applied to other technologies. (Harris, Mishra, & Koehler, 2009). TK goes beyond knowing how something works to understanding, and demonstrating, how the technology can be applied productively at work and to day-to-day tasks (Koehler, 2017). An example of this would be knowing that *Microsoft Word* can publish documents, but also using the software to write and produce text for work.

Pedagogical Knowledge. Pedagogical Knowledge (PK) is common amongst teachers. It is the knowledge about how students learn, and the methods and processes involved in teaching (Koehler, 2017). This knowledge includes planning, student data analysis and classroom management. It incorporates teachers' skills and techniques in the classroom, and the ability to address students' needs and interests.

Content Knowledge. Content Knowledge (CK) is about the knowledge of the curriculum. It is the understanding of the curriculum; the topics, concepts and skills that need to be passed on to the students. It is about the specific knowledge of each learning area, such as primary sports, high school music or dance. It also goes beyond the content, as the knowledge includes the theories, organisation and established practices included within the content topic (Koehler, 2017).

These three components intersect, producing three additional components:

Technological-Pedagogical Knowledge. The Technological-Pedagogical Knowledge (TPK) component is defined, by Harris et al. (2009) and Koehler (2017), as the way teaching and learning changes through the integration of technology. It is the understanding of the functionality of each technology, how it can be implemented in teaching and learning, and how to overcome the constraints of the technology when teaching. It is linking the 'how to teach' with the 'how it works'.

Pedagogical-Content Knowledge. The Pedagogical-Content Knowledge component, briefly described above, is about the conversion of the curriculum content for the purpose of teaching and learning. An understanding of content does not immediately translate into successful teaching of the key concepts or skills of that content. PCK incorporates and links students' prior learning, teaching strategies and content ideas (Harris et al. 2009). Combining these areas works to strengthen the links between learning, curriculum, assessment and pedagogy (Koehler, 2017).

Technological-Content Knowledge. Technological-Content Knowledge (TCK) is an understanding of how the content and technology can complement and constrain each other. It is the understanding of how technology provides avenues to understand existing content and which new content can be developed. TCK is also understanding which technology should be used with a particular content (Koehler, 2017).

The final intersection of the three blended components above, TPACK, is a harmonisation of the different knowledges for using technology in instruction. TPACK makes technology use in learning spaces meaningful and allows a teacher to demonstrate mastery in teaching (Koehler, 2017; Mishra & Koehler, 2006).

Technological-Pedagogical-Content Knowledge. The all-encompassing banner of Technological-Pedagogical-Content Knowledge (TPACK) involves the teaching of curriculum and content knowledge, and the use of pedagogies that take advantage of technology to construct and teach the content. It targets the students' learning needs and acknowledges students' prior learning (Harris et al., 2009). It provides a way to strengthen existing knowledge and understanding, and provides a way to create new ones (Koehler, 2017, Padmavathi, 2017).

Despite the many ways to achieve TPACK (Harris et al., 2009), TPACK's limitations exist in its lack of practical application and a link with teachers' context (McLoughlin, 2015). This is despite some acknowledgement of context, as seen in Figure 2.1. This problem is compounded by the fact that there is no defined method in which to guide teachers in achieving TPACK, as the literature suggests that there cannot be a single solution that can be applied generally to all teachers (Mishra & Koehler, 2006; Niess, 2011). This appears to be especially true when, as mentioned in section 2.1.1, there exists varying technologies within each teachers' learning environments and, therefore, teachers would have access to the different affordances of their available technologies. These limitations show the framework's inability to provide enough guidance for a professional learning structure, when considering its compatibility with the factors facilitating effective professional learning.

2.3.2 The SAMR Model

Another framework commonly referred to in the literature was Puentedura's SAMR Model (2015, 2016), which progresses ICT integration through four stages with the aim of moving towards the final 'successful' stage in redefining teaching and learning. Hamilton et al. (2016) suggested that its popularity is due to its simplicity, since it provides guidance for teachers who find integration mastery a complex issue. An examination of the straightforwardness of the SAMR Model is presented below.

The first two levels of the model, substitution and augmentation, are defined as enhancement (Puentedura, 2015, 2016). These stages show the use of ICT as enhancing strategies already used. However, the purpose of SAMR is to move beyond enhancement, and for teachers to use ICT to transform teaching and learning, through modification and redefinition (Hos-McGrane, 2010; Puentedura, 2015, 2016). Figure 2.2 describes each stage of the SAMR Model defined in order of progression.

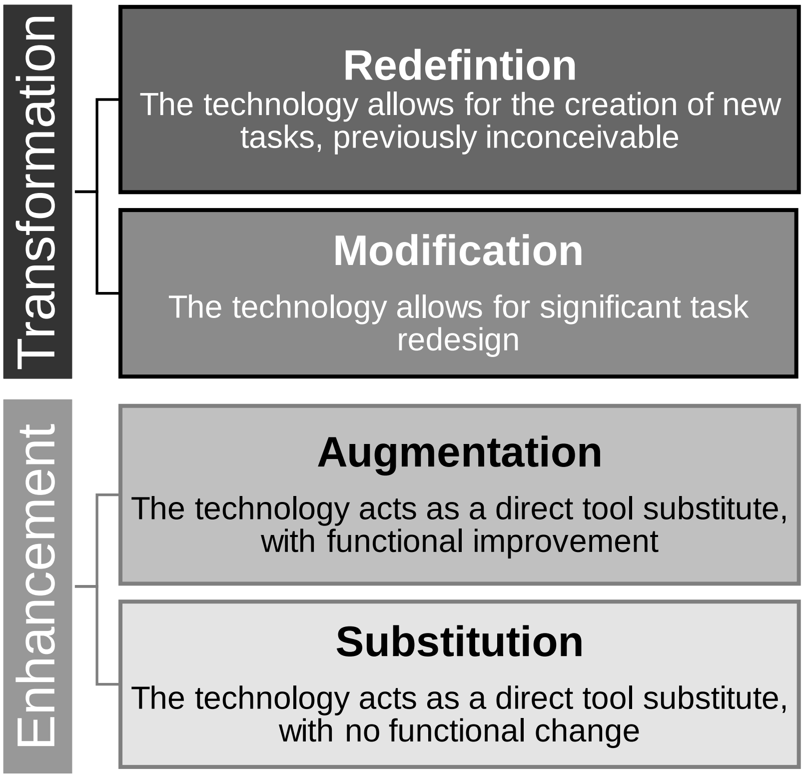


Figure 2.2. A representation of the SAMR Model (as seen in Puentedura, 2015, 2016)

Substitution. Substitution is the lowest stage of the use of ICT in teaching and learning. There is little pedagogical change or alteration to lesson content. As the name suggests, substitution is replacing old tools, such as pen and paper, with new. For example, instead of handwriting a story, the students would use *Microsoft Word*.

Augmentation. Augmentation builds on substitution while remaining in the enhancement section of the model. Augmentation makes use of additional functions that the technologies may provide. For example, students substituted handwriting with word processing and then augmented this by uploading their work online to share with a wider audience.

Modification. Modification enters the transformation section of the framework. The task has been redefined and student learning has changed. The same document is now uploaded to *OneDrive*, an online cloud storage platform that allows for document collaboration, so that it allows collaborators to add their ideas and feedback for the purpose of improving the original writing.

Redefinition. Redefinition is the highest level of the SAMR Model. This redefines the task to be completely different from what would have been done historically. In the same example, this may mean that rather than a core author, an online collaboration of a team of authors may write the story together, using comments, chat or other tools to discuss the development of the writing. The authors may decide to present the text in a different format, possibly a website or a blog, or they may completely redefine the task as a video or stop motion animation. The new task does not remove the depth required of the storytelling, but redefines how the story is constructed and presented.

Issues relating to using the SAMR Model

The SAMR Model is not, however, without criticism. One main criticism is its lack of theoretical explanation in scholarly articles. This lack of explanation has led to teachers interpreting the framework in different ways, leading to the misunderstanding of the purpose of the SAMR Model (Hamilton et al., 2016). Three other criticisms include the framework's absence of context, its rigid structure and that it has a focus on product over process.

The SAMR Model was criticised for its lack of contextual linkage, as each stage is defined as a black and white demonstration of skills, knowledge and understanding (Hamilton et al., 2016). Without an understanding of the factors surrounding the teaching and learning behaviours, interpretations of teachers' ICT integration abilities and application are meaningless. For example, demonstrating redefinition of learning using ICT without considering students' needs is impractical.

Another criticism is the rigidity of the framework. Given that the framework works as a taxonomy where teachers progress from the basic level of substitution to redefinition, each level is defined by the behaviours a teacher should exhibit.

Hamilton et al. (2016) explained this rigidity causes the SAMR Model to disregard the complexities of teaching. This rigidity ignores appropriate strategies addressing students' needs in favour of showing a higher level in the framework.

Finally, another suggested problem of the SAMR Model was its focus on the end product rather than the process undertaken to achieve the product (Hamilton et al., 2016). Rather than the skills and aptitudes a student develops during the process of learning, the framework focuses on what the student produces at the end of the learning. For example, a teacher may focus on the digitally produced slideshows that the students create as a result of the learning, rather than the skills of research, collaboration or presentation.

2.3.3 Interactive Whiteboard Frameworks

Despite Beauchamp's *Transition Framework* (2004) being targeted specifically for IWBs, it appears to have adopted the benefits of the SAMR Model, in that it is easy to use, and overcomes the limitations of the TPACK Framework, by providing practical application through the indicators. These specific indicators are presented in a progressive scale. The indicators describe the behaviours of the teacher that are evident at each level in the framework. Like the SAMR Model, Beauchamp's framework progresses through different stages, ranging from the lower level of black/whiteboard substitution to synergistic user. The aim for each level is to build on the skills of the lower levels. Within each level, the different sets of skills are categorised into four domains, allocating the demonstrated skills by *Operating System Use and File Management*, *Mechanical Skills*, *Program Variables*, and *Classroom Management and Pedagogy*. Beauchamp (2004) found that the successful application of this framework in schools proved its relevance as a developmental model for teachers. He claimed that the progressive framework individualises professional learning in the use of IWBs for teachers, where teachers' learning requirements are met within a self-paced and flexible environment.

Sweeney's *Interactive Whiteboard Developmental Framework* (2008) is an extension of Beauchamp's (2004) framework, but it incorporates five other frameworks and findings from a longitudinal study. Sweeney's framework conceptualised Australian teachers' concerns, competencies and characteristics as they developed in their use of IWBs (Sweeney, 2008). Also, like Beauchamp's framework, Sweeney's framework is progressive and includes behavioural indicators. The juxtaposition of the frameworks shows a high level of similarity. In comparison with Beauchamp's framework, out of the 49 indicators:

- 14 are identical
- 11 have been added to or amended from Beauchamp's framework
- 24 are new.

Examples of such similarities and differences can be seen in Table 2.3.

Table 2.3

A comparison of two IWB frameworks using examples

Identical/Added or Amended/New indicators	Transition Framework (Beauchamp, 2004)	Interactive Whiteboard Developmental Framework (Sweeney, 2008)
Identical indicators	1.2 Limited use of stored files (e.g. Word files with spelling lists or grammar exercises) – opening files	1.2 Limited use of stored files (e.g. Word files with spelling lists or grammar exercises).
	2.3 A limited use of 'external' material – e.g. Internet or material from school network	2.3 Limited use of external resources (e.g. Internet or school intranet)

Identical/Added or Amended/New indicators	Transition Framework (Beauchamp, 2004)	Interactive Whiteboard Developmental Framework (Sweeney, 2008)
Added or amended indicators	3.1 Ability to maximise or minimise files to allow multiple programs to be open and switched between	3.3 The ability to use tab browsing and minimise or maximise windows to switch between applications (e.g. 'flip chart' and browser).
	3.1 Children select tools and input to the IWB	3.1 Teacher initiated and planned opportunities for students to select tools, and interact with the board to apply and analyse conceptual knowledge (e.g. Students manipulate learning objects and mathematics tools, and play games).
New indicators	-	3.5 Retrieval of saved 'flip charts' by teacher to review and continue learning.
		4.5 There are opportunities for students to demonstrate their inquiry based learning skills to an authentic audience using the interactive whiteboard (e.g. students present their personal digital project to peers or assist the teacher to co-construct learning resources).

Sweeney (2008) acknowledged that there are factors and complexities that influence teachers' learning and practice and, therefore, the framework can only act as a support for teacher development. She explained that the framework provides a guide for teachers to evaluate their practice and to initiate professional dialogue, and develop plans for ongoing learning in the use of IWBs.

The benefits of these two IWB frameworks are the clarity of each behavioural indicator and the support they provide for the individual learning for teachers. They encourage reflection and dialogue, and allow teachers to consider their contextual factors in terms of their development. However, despite these benefits, the main limitations of Beauchamp's (2004) and Sweeney's (2008) frameworks are that they are restricted to the interactive whiteboard and, in their current forms, these frameworks cannot be simply applied to other tools.

2.3.4 Summary of the frameworks

An analysis of the four frameworks, the TPACK Framework, the SAMR Model and the two IWB frameworks, highlights advantages and limitations of each. The underlying principles for a developmental framework for digital technologies should consider:

- acknowledging teachers' existing skills, knowledge and understanding, students' needs, and school-based factors that contribute to teachers' ability to integrate interactive technologies.
- providing clarity and defined indicators for teachers so that it provides simple and easy-to-follow behaviours. This simplicity, however, should not neglect teachers' context nor disallow variations where needed.
- building technological knowledge into pedagogical knowledge. In this way, teachers' use of technology facilitates teaching and learning.

These principles were used to inform the development of the framework used in this study (Figure 3.2). As seen in the draft framework (Figure 3.2), the structure adopted was that of Beauchamp's (2004) and Sweeney's (2008) frameworks. This was so that it provided clear and defined indicators of teachers' skills, as reflecting the first point mentioned above. These indicators allowed for teachers to identify their current skill levels, and to identify and address any potential areas for development. These indicators use clear language and defined behaviours to facilitate teachers' understanding of the necessary skills and behaviours, such as required by the second point.

To expand on the IWB frameworks, the draft framework in Figure 3.2 must allow for the integration of a wider range of current and developing technologies in learning spaces, as well as the skills and behaviours that would be more technologically agnostic. To accommodate for this, the TPACK Framework (Koehler, 2017; Mishra & Koehler, 2016), as described in section 2.3.1, was used to adapt the existing indicators in the IWB frameworks. The beginning of the new framework, from Stage 1: Substitution, describes skills reflecting the individual TK and PK, while the later skills, towards Stage 5: Synergy, moves towards the intersected TPK, such as described in the third point above. The framework also reveals skills and behaviours that progressively, as one moves up the framework, reflect the realisation of the beneficial affordances of technology in education, such as outlined in section 2.1.1. A more detailed description of the way the framework was initially developed can be found in section 3.4.1.

2.4 Summary of the chapter and implications for this study

With an increasing number of new technologies available for educational purposes, the literature review has revealed a need for ongoing professional development and learning to support teachers in building their capacity to integrate interactive technologies. This strengthened capacity can then be used by teachers to assist in overcoming influencing contextual factors from their schools and learning spaces.

The review has suggested that mentoring offers a solution to the professional learning approach for this study, as it reflects factors that contribute to effective professional development and learning found in contemporary research findings. Mentoring is ongoing, individualised, collaborative and provides the means for reflection on practice. The literature reviewed showed that teachers' adoption of professional learning is further improved when the learning is conducted within their schools and with teacher mentors with whom they have already established professional respect and rapport. To facilitate ongoing professional respect and rapport, the research suggested that mentors require an aptitude for empathy, as well as expertise in the content area.

The review examined four developmental frameworks for integrating technologies, the TPACK Framework, the SAMR Model and the two IWB frameworks, and revealed those features that should be integrated into a proposed developmental framework. This proposed framework has been developed for this study, as will be described in Chapter 3, and has adopted the features that appeared to facilitate a mentoring model for developing teachers' skills in integrating technologies. The purpose, then, is to test this framework as a way for mentors to set achievable and manageable goals, and provide suitable advice and support to their mentees.

The literature review provides a compelling rationale for the importance of the study. Firstly, the literature regarding the factors that influence teachers' integration of ICT has been mostly drawn from secondary and tertiary settings. It is, therefore, important to examine the practicality of these factors within a primary context, and to identify any unique factors emerging from primary schools. Secondly, an examination of the features of successful professional learning and mentoring will be conducted in primary schools to test their strength in that setting. Finally, the literature reviewed has revealed strengths and weaknesses from each of the examined frameworks. The strengths of these existing, but largely theoretical, frameworks have informed the development of a new practical technology integration framework, which was tested in this study to assess the ways in which it can facilitate the professional learning.

The following chapter outlines the methodological approach and strategies in which these areas were explored.

CHAPTER 3
METHODOLOGY

The literature reviewed in Chapter 2 indicated that integrating interactive technologies for teachers is a complex issue that is influenced by a range of different factors. The literature reviewed with regard to professional learning design suggested that certain features of professional learning and mentoring lead to a higher probability of success in building teacher capacity and changing teachers' value of a technology integration approach to teaching and learning. Specifically, the features of effective professional learning and mentoring meant that when designing the research study, the following points emerged as pertinent:

- The study should be conducted in-context when collecting the data. This would allow the data to be reported and interpreted based on the cultural behaviours of the participants within their own contexts, similar to an ethnographic study (Babbie, 2016; Bryman, 2008). AITSL (2014) stated that the better the understanding the deliverer has of the context, the more successful the professional learning will be, if that understanding is utilised.
- To ensure the effectiveness of the professional learning activities, the study must be implemented so that teachers value both the content (Orlando, 2014) and the professional learning method (Hadley et al., 2015).

These key points suggest a predominantly qualitative approach to the study, which is described and further justified in this chapter. This chapter will first explain the research design and methodology, and then lead to a discussion of the way in which the data were analysed. Consideration for data reliability, validity and the ethical conduct of the research are also described in this chapter.

The chosen methodology and methods outlined in this chapter were based on the three research questions that were first described in Chapter 1, these being:

1. What factors influence the way primary teachers integrate interactive technologies in their learning spaces?
2. What features of a mentoring model can facilitate building primary teachers' capacity for integrating interactive technologies?
3. In what ways can a structured technology integration framework facilitate professional learning?

The action research model ultimately adopted for the study, as explained in section 3.2.1, partnered the researcher with the participants in a naturalistic inquiry approach. This allowed participants to gather and interpret their own data (Stringer, 2008). The effectiveness of teaching strategies varies from teacher to teacher, based on context and teacher experience (Hattie, 2013b). It was with this principle in mind that the purpose of this research design was established: to encourage the participants to engage with the study, and to interpret the application of the framework and professional learning activities based on the participants' own understanding and perception.

3.1 The research paradigm

Introduced in section 1.3 were the ontological and epistemological positions adopted in this study. These theories informed the research design described in detail within this chapter, and influenced the ways in which the data were collected, analysed and reported.

This study adopted pragmatism as its ontological approach. Pragmatism in social research such as this assumes that data collected must be understood within the individual context, disallowing that a single and standard 'truth' can be acquired (Kaushik & Walsh, 2019). This approach assumes that knowledge acquired from each reality is grounded by the context from which it emerges and, because of this, the knowledge from each reality is ever changing. Particularly, this theory assumes that multiple 'truths' will emerge. In this study, with its different cases, assumptions were made that each case would present different ideas, as well as variations to those ideas that may initially appear common across the cases. This allows for a deeper understanding and recognition of the diversity that exists within each school, and in their teacher and their student populations. Also, it is assumed that other studies in the areas of technology integration and teacher professional learning, which have been outlined in Chapter 2, have been conducted in a great diversity of contexts, and therefore it is not the purpose of this study to confirm or refute any findings made by previous studies, but rather to add to this knowledge and examine any variations that may emerge. This approach is particularly useful in this study, as it seeks to solve practical problems in the world, allowing the researcher to examine the issues identified, as described in section 1.1, and focusing on resolving these through the research purpose and by addressing the research questions. As this approach is based on one's social experiences (Kaushik & Walsh, 2019), it allowed the researcher to examine the experiences in which the participants in the study engaged and to construct new knowledge to address the research questions. This approach to constructing knowledge, or epistemological approach, reveals that the study is primarily constructivist in its theoretical underpinnings (Perry, 1999).

Constructivism acknowledges the learner as an active participant in the development of new knowledge, by interpreting and building on their experience (Perry, 1999). The aims of this study emphasised the need for interpretation within the independent contexts as a constructivist approach argues that interpretations cannot be separated from the location in which they exist (Kincheloe, 2005). This led to the choice of methods that allowed the participants to engage with Socratic discussions, and to build and develop, in both the mentee and mentor, a mutual understanding of the social behaviours and actions seen during each lesson observation (Kalpana, 2014). This position is consistent with Vygotsky's perspective of social constructivism (Perry, 1999). The constructivist approach acknowledges that the learner is able to construct new knowledge based on their own understanding and experiences in the process (Kalpana, 2014). Perry (1999) explained that learning in a constructivist model focuses on providing the learner with strategies which they can use to assimilate and demonstrate new knowledge. In this study, this is shown through the professional learning model and in the instruments that provide a structure for this model. Both this study and the professional learning model assumes that new knowledge is shaped by the context from which it exists, as well as by the interactions in which this knowledge was acquired.

Also, this study approached constructivism critically. Critical constructivism espouses that knowledge cannot be simply transmitted without the interpretation of the recipient (Kincheloe, 2005). Critical constructivism requires researchers to reflect on the realities, or the occurrences during the lessons observed in this study, and to consider their impact on the practices of the participants (Kincheloe, 2005). Critical constructivist epistemology addresses knowledge in the same way as constructivism, where this approach argues that knowledge is perceived and then shaped by those who perceived it. This perception then allows the participants to critique and reflect on the reality in which they exist, to recreate this reality, and to change the way in which the participants exist within this new reality (Kincheloe, 2005). This is especially pertinent for this study, as the action research cycles allowed the participants to continually reflect on their practices and the learning spaces in which the practices were performed. It then provided opportunities for the participants to react and change their practices based on the new knowledge acquired as a result of their reflections. These cycles of action and reflection allowed both the research and the pedagogy to synergistically enhance each other.

A critical constructivist approach also requires those who are part of the world to be part of interpreting the world (Kincheloe, 2005). Therefore, the research design and the analysis approach adopted in this study followed an interpretivism philosophy. This philosophy engaged the participants as researchers, aligning with the action research design. In an interpretivist philosophy, three levels of interpretations occur (Bryman, 2008). The first is when the participants interpret the occurrences and the forces on these occurrences within the realities around them. In this study, these were the reflections produced by the participants. The second level of interpretation is when the researcher analyses the interpretations of the participants. The analyses conducted by the researcher in this study were supported by his experience as a primary school teacher and an educational consultant. These analyses were further informed by his growing understanding of the features and factors relating to the integration of technology in primary schools and effective professional learning as he engaged further with the study. A third level of interpretation occurred when the researcher's analyses were further interpreted against those concepts, factors and features identified in the literature and shown to affect teachers more globally. This third level of interpretation is to acknowledge that while occurrences, such as those in the case studies, appear to be isolated within their unique contexts, they also exist within larger and ever-changing realities (Kincheloe, 2005). Despite this third level of interpretation being grounded in the wider scope of literature relating to technology integration in education, the interpretative stance also allowed the researcher to identify new features of, and variations to, existing features that emerged from the unique schools and participants in this study (Bryman, 2008).

It is with this research paradigm and these assumptions in mind that the design of the study was established. The design, as described in the following section, adopted a data collection methodology that allows for data to be collected within independent contexts and provided ways in which these data can be interpreted within the context in which they existed, as well as how these data were influenced by or interacted with the greater research body in the areas of technology integration and teacher professional learning.

3.2 Research design

The complexity of the issues revealed in the literature review suggests that in order to fully explore the depth of experience and responses to the framework and the mentoring in this study, an explorative approach should be adopted, since such an approach provides a way to know more about the topic (Babbie, 2016).

The explorative study adopted here was designed to identify the factors and features that hindered or enabled primary teachers to integrate interactive technologies, and also to identify the specific nuances of each case that existed. This explorative approach led to methods that were qualitative by nature. Qualitative methods provide opportunities for the researcher to pay careful attention to specific details and are not restricted by pre-determined categories (Patton, 2002). While this study allowed for identification of those existing factors and features found in the literature from Chapter 2, the freedom from pre-determined categories also allowed for identifying and examining those factors and features that were unexpected.

While the study mainly utilised qualitative methods to gather the data, a survey with close-ended questions was also used. The survey provided an alternative method of seeking feedback from the participants about the framework and the professional learning model, increasing the validity of the results through cross-checking and triangulating the different sources for consistency (Bryman, 2008; DoE, 2017c; Robson, 2002).

3.2.1 Action research in case studies

Practitioner inquiry is a highly valued strategy for professional development and learning (Hadley et al., 2015). Furthermore, the perspective of ‘teacher as researcher’, adopted in action research studies, builds skills and professional confidence (Teague & Anfara, 2012). Action research is a form of practitioner inquiry that targets the participant’s practices, their understanding of these practices, and their understanding of the contexts and conditions that shape these practices (Kemmis, 2009). However, this form of practitioner inquiry has drawn criticism from some academics. Because this research approach relies on the interpretation of the participants, some have argued that this approach lacks rigour and can be too subjective (Bryman, 2008). While this may appear true, qualitative research such as this can still demonstrate research rigour and produce data that are both reliable and valid. Discussions around issues of rigour, and data reliability and validity will be discussed in more detail in section 3.6.

Consistent with the critical constructivist theory adopted in this study, another benefit of action research is that it not only provides opportunities to develop greater understanding in the field, but also serves the participants as a method of development and education (Babbie, 2016; Kemmis & Wilkinson, 1998; Kincheloe, 2005). Hardy et al. (2017) explained that action research provides opportunities for participants to develop leadership skills and abilities, just as the process inspires teachers to change pedagogically. In addition, action research reflects features of effective professional development and learning by providing:

- individualisation of learning, through acknowledgement of mentees’ existing knowledge, and then building on and transforming the mentees’ skills and attitudes (Kemmis, 2009, 2010; Stake, 1978).
- opportunities for both the mentor and mentee to negotiate the next steps, through the fairness in the balance of power between the mentor and

mentee (Kemmis, 2010; Mattsson & Kemmis, 2007). One of the strengths of action research is that it allows participants to engage in a social process, and to collaborate and communicate with each other (Hardy et al., 2017; Kemmis & Wilkinson, 1998).

- opportunities for the participants to be reflective (Kemmis, 2006; Reason & Bradbury, 2001), and allows the participants to jointly discuss and analyse in a discursive manner (Hardy et al., 2017). Action research is a reflexive process, where participants investigate the reality in order to change it (Kemmis & Wilkinson, 1998).

Also, the mentoring model described in this chapter allows for the mentee to have prolonged exposure to the learning. Professional learning designs and mentoring models that allow the learner to engage for a longer period of time are more likely to result in increased effectiveness and greater success (Ernst & Erickson, 2018; Hramiak & Boulton, 2013; Whitworth & Chiu, 2015).

Action research works well in a case study design. Case studies allow the researcher to analyse and study the complexities of a specific context (Babbie, 2016; Bryman, 2008; Goodrick, 2014). Case studies, in general, are a type of ethnographic study (Ary et al., 2014), which seek to objectively and accurately describe what is observed (Babbie, 2016). As case studies are contextually bound (Kemmis, 2010; Mattsson & Kemmis, 2007; Stake, 1978), this study’s design aligns well with the research paradigm adopted in this study and with a key feature of successful professional development and learning, as described in section 2.2.1. In particular, it allowed the participants and the researcher to examine the social interactions and behaviours within the contexts in which they were realised, developing understanding of how each unique context influenced the behaviours of the social actors in each case.

While it may appear that case studies that are contextually bound cannot be objectively described, Kemmis and Wilkinson (1998) argue that studies of practice examine both through the lens of the subjective, such as in examining individual knowledge, values and motivation, and the lens of the objective, such as through group behaviours. In this study, the relationship between the subjective and the objective was seen through the collaborative reflection process (as described in section 3.5). In this process, the participants reflect both subjectively, by examining the lesson occurrences through their knowledge, values and understanding, and objectively, by describing lesson occurrences as perceived externally by the mentor. In Chapters 4 and 5, the researcher, too, was able to describe objectively the group behaviours across the cases and also able to provide reasons for these behaviours by using the participants' subjective reflections.

Despite the fact that a case study can be objectively described, one of the major limitations of a case study design is that case studies cannot be generalised. Bryman (2008) explains that it is impossible for any case to be representative of the greater population and to be typical enough to yield results that can be applied generally to others.

To mitigate this limitation, two strategies, described in more detail in section 3.2.2, were engaged in this study. These strategies included:

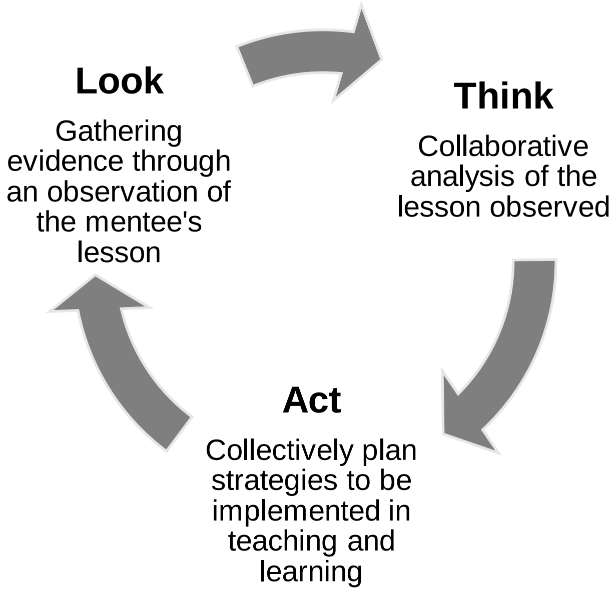
- adopting a comparative case study design, where more than one case was examined in detail. Such a design overcomes the limitation of studying just one example, which, as mentioned, cannot be representative of the broader population (Babbie, 2016). This allowed the researcher to identify group behaviours across the cases.
- providing detailed narratives of each case, so that the intended audience is given the opportunity to examine the unique features of the cases. However, Bryman (2008) cautioned oversimplifying the differences in the

case studies’ results by attributing such differences to the distinguishing features of the cases.

The features of action research described above, combined with the framework’s focus on teachers’ development of skills in integrating interactive technologies, led to the decision to adopt an action research approach using case studies.

3.2.2 Formulating the action research cycle and the case studies

Action research undergoes a cyclical and repetitive process, and therefore has the potential to sustain the learning process (Kemmis, 2010; Mattsson & Kemmis, 2007). A model of the action research cycle, as described by Kemmis and Wilkinson (1998), is the self-reflective spiral. The spiral follows the processes of planning, acting and observing, and reflecting. The spiral then engages in a process of re-planning before repeating. This spiral not only acknowledges that action research is iterative, but also that it builds on the actions of previous cycles. While this process may appear rigid, the authors explained that, in action research, the processes often overlap and that deviations from this structure may occur (Kemmis & Wilkinson, 1998). However, in an attempt to follow the principle, as described above, that action research needs to individualise learning and acknowledge the mentee teachers’ existing knowledge, the spiral did not appear to be adequate to represent the action research and mentoring process of this study. Participants were entering the process at the observation point of the spiral and reflection was more likely to occur at multiple points within the spiral. Therefore, a more accurate representation of the action research model adopted in this study was the Look, Think and Act Model described by Stringer et al. (2010), as seen in the diagram in Figure 3.1.



Model derived from Stringer et al. (2010)

Figure 3.1. The Look, Think and Act Model of action research

This cycle was used in each case of the study described in this thesis. The participants '*thought*' about what the mentee needed to progress on the framework, the mentee '*acted*' on the plan, and then the mentor and mentee '*looked*' at the new skills the mentee demonstrated in the following lesson. The cycle was then repeated, as the participants considered and planned for the next steps. Hardy et al. (2017) warned that action research should not be mistaken as simply a research method, but rather as a way to understand how to link knowledge to practice. Action research is consistent with a constructivist position. In this study, the participants in the *'thought'* process of the cycle were able to examine the actions that occurred within their lesson observations, consider the possible learning from each lesson, and critically construct new knowledge and strategies to apply to the following cycle.

Another consideration was the number and nature of the cases needed for the study. The complexity of issues described in the literature, along with the need to triangulate the data from a number of sources (Bryman, 2008; DoE, 2017c; Robson, 2002), suggested that at least three case studies would be needed to allow for sufficient evidence and effective comparison. It was considered that three case studies would be the point when the data would approach saturation. Data saturation serves as a criterion for discontinuing research (Glaser & Strauss, 1967; Saunders et al., 2017). Data are considered saturated when no new categories of data emerge. While different case studies would present unique contextual information, indication for data saturation in this study would occur when the analysis of the data would reveal the same categories across the case studies.

However, the complexities of issues from the literature, combined with considerations for sustainability, suggested that perhaps more than three case studies might be preferable, to confirm the point of data saturation and to mitigate the risk that some cases might prove to be unsustainable over the duration of the study. In addition, when deciding the threshold of the number of case studies, the ability of the researcher to manage the amount and nature of the data for the scope of this doctoral study was also considered. It was decided by the researcher and his supervisors that, from a small number of schools and teachers willing to participate, five independent case studies would be selected. Table 3.1 shows the expected data from these five case studies, while Table 4.1 reports on the actual data received. Descriptions of the instruments mentioned in these tables can be found at section 3.4.

Table 3.1

Anticipated data from each case study

Type of data	Number expected
Audio recordings (of reflection meetings)	6
Lesson Observation Field Notes template (Field Notes Template)	6
Review Forms	5
Recording Tool	2
Surveys	2

The number of case studies, as well as the amount of data that was anticipated to be received from them, were considered by the researcher and his supervisors to balance the need for sustaining the study and the need for a varied result, and to ensure project manageability. However, a decision was made that, if necessary, more than five case studies would be conducted if the data did not appear to reach saturation, as defined above, by the end of the initial three case studies as anticipated.

The case studies outlined in this thesis served two purposes. The first was to provide the audience with resonating contextual features and factors which may reflect the audience's own context. Similarly, participatory action research is grounded in the participants' context, forcing any findings described to be established from and shaped by the participants' contexts and practices, rather than being abstract and imprecise (Kemmis & Wilkinson, 1998). For this reason and given that case studies are not bases for generalisations (Mattsson & Kemmis, 2007; Shulman, 1986), it was considered important, as explained by Ary et al. (2014) and Stake (1978), to provide a detailed narrative so that resonance can be found by the audience. Also, AITSL (2014) noted that professional learning designs are rarely perfect the first time around and often need to be adapted to suit the individual participants and contexts. Therefore, the narrative would allow the audience to make judgements on the suitability and adaptability of this professional learning model in their own school context. The other aim for the case studies was to bring to light those factors that would facilitate greater success to the professional learning model and the framework in schools. Such case studies are known as 'comparative case studies' (Goodrick, 2014). Comparative case studies work to synthesise the common and the different, and to identify the patterns across two or more cases (Goodrick, 2014). Also, Bryman (2008) argued that comparative case studies, or multiple-case studies, better position the researcher in theory building and contribute to mitigating a case study design’s main limitation, which is that it cannot be used as a basis for generalisation (Mattsson & Kemmis, 2007; Shulman, 1986). The findings from this study are presented in Chapter 4, grouped by each case study and in categories determined through analysis, to allow for later comparison in Chapter 5. The findings are compared across the case studies, organised in a manner to best address the research questions. The purpose of Chapters 4 and 5 is to provide the audience with the contextual factors for implementation, so that they can make judgements as to whether or not the professional learning model and the framework would be suitable for their own unique learning needs and scenario.

3.3 Recruitment and participants

It is necessary to note that this study only recruited schools that would be able to engage with the professional learning model in a face-to-face manner. A remote mentoring model that operates using digital technologies, such as examined in section 2.2.1, was considered early in discussions between the researcher and his supervisors. Although this would have allowed schools that may not have access to suitable mentors to participate, and there was agreement that this would yield interesting data alongside those cases that would operate predominantly face-to-face, it was finally decided that implementing this model of learning would add complexities that were beyond the scope of this study. As there is still value in examining the mentoring model within a remote learning environment, a possibility for future studies in this area is raised in Chapter 6.

There was an intention to recruit schools from the wider variety of schools within the three broad systems existing in NSW, being Public Schools NSW, Catholic Schools NSW and independent schools. To do this, the following ethics procedures were undertaken so that the schools in these systems could be approached.

3.3.1 Ethics application and approval

There were three layers of ethics application approval. Firstly, the research application was peer reviewed by impartial academics at the University of Tasmania: Faculty of Education. Secondly, the amended application was then submitted to the university's Human Research Ethics Committee (HREC), who assessed the application's adherence to the National Statement on Ethical Conduct in Human Research (Australian Government: National Health and Medical Research Council, 2007). Following HREC's ethical approval (seen at Appendix A), approval was sought from the educational systems existing in NSW.

Each school jurisdiction had a different application and approval process. These independent processes are described below.

- Public Schools NSW – to undertake research in a NSW Government school, approval must be granted from the State Education Research Application Process (SERAP). This approval was granted 3 August 2016. The approval and its extension can be found at Appendix B. This approval, as well as other older documents, refer to a previously conceived title of the same study.

As will be discussed in more detail in section 3.3.3, there were no participants from the two other educational systems in NSW. However, the following procedures were conducted in an attempt to recruit from these two systems.

- Catholic Schools NSW – approval to conduct research in Catholic schools must be provided independently by each diocese. Applications were submitted to two dioceses. One was rejected due to lack of interest from schools in participating, while the other was approved. The researcher was also unable to find schools interested in participating from the second diocese.

- Independent schools – each independent school has their own application and approval process. While some schools approved the study, no participants could be found at those schools.

3.2.2 Factors for school selection

A purposeful sampling method was engaged in this study. This approach was adopted as it allows for the selection of cases that will return rich data, under the constraints of the resources available for the study (Patton, 2002). A number of factors were considered when selecting the participating schools. These factors included the type and size of school, and the background of the potential teacher participants.

Type of school (*jurisdiction; geolocation*). It seemed useful to conduct the research within schools of different jurisdictions, as schools are governed by different policies and procedures. Although, as seen in Chapter 2, the geolocation of a school might not affect teachers' access to technologies, the remoteness of a teacher might affect their access to a suitable mentor during this process and might present valuable data relating to the professional learning model itself.

Size of school (*based on student enrolments: small (under 150); medium (between 151 and 400); large (above 400)*). Access to expertise and school timetables would play a significant role in influencing how the mentoring structures were implemented. Given that the selection of the 'right' mentor needs to be carefully considered, it was anticipated that a larger school could provide a wider choice of mentors.

Interested teachers' background (*specifically, the school year they were teaching*). As the Australian Curriculum covers a variety of digital technology learning and ICT capabilities across school years, the availability and viability of these technologies across Foundation (known as Kindergarten in NSW) to Year 6 would be different. Teachers across the school years may have different access to technologies, as well as teaching to different outcomes.

Other factors. Many other factors concerning the nature of the schools were considered as possibly affecting the study. These included variations such as single-sex versus co-education, religious versus non-religious, and differences in the socio-economic variations between school communities. However, while such data might provide interesting comparisons across the different cases, it was not considered feasible to address all of the possible variables within this study. In the case of socio-economic status in particular, the equity funding in the RAM (DoE, 2018c) negated this as a variable when ultimately all five cases came from Public Schools NSW.

3.3.3 Making contact and recruitment

As revealed in section 3.3.1, different approval processes were required prior to making contact with the schools in the three major educational jurisdictions in NSW. Once approval was granted, schools could be contacted.

The communication strategy to engage expressions of interest from principals across NSW was via email and phone. More than 50 schools across the three educational jurisdictions were contacted, but relatively few positive responses were received. While there was some interest from non-Government schools, principals of these schools were unable to find participants or eventually felt it was not the right time to engage with the study.

Despite the intention in drawing a more diverse sample, all five cases ultimately selected for the study came from government schools in NSW (see Table 3.2). This may appear as a possible limitation. However, the analysis process, as described in more detail in section 3.7, yielded not only themes that are specific to this study, but also themes that are consistent with those found in the literature examined in Chapter 2. Finding these similar themes is especially relevant, as the other studies were conducted in a wider variety of schools from around the world.

The possibility of testing this particular professional learning model in a broader sample in the future will be discussed in Chapter 6.

Table 3.2, as well as the descriptions of the schools described after the table, are accurate as of 2017, when the case studies were conducted. The student age approximations in the case studies' descriptions after Table 3.2 are guided by the compulsory school starting age of five (DoE, 2018g), and how students advance scholastically each year in NSW (NESA, 2018c).

Curriculum stages are placed alongside scholastic grade levels, as students from the same stages are taught to the same or similar outcomes (NESA, 2018c).

Table 3.2

Summary of cases

Case	School	Participants		Stage	Grade level
1	Ridge Primary School 584 students	Mentor	Allan	2	Years 3 & 4
		Mentee	Sally	2	Years 3 & 4
2	Hunter Primary School 333 students	Mentor	Rob	3	Years 5 & 6
		Mentee	Angela	Early Stage 1	Kindergarten
3	River Primary School 302 students	Mentor	Andrew	3	Year 5
		Mentor	David	3	Year 5
		Mentee	Kelly	3	Year 5
4	Edge Primary School 362 students	Mentor	Jennifer	2	Year 4
		Mentor	Sarah	1	Years 1 & 2
		Mentee	Debbie	1	Year 2
5	Tableland Primary School 237 students	Mentor	Stuart	3	Years 5 & 6
		Mentee	Ronda	2/3	Years 4 & 5
		Mentee	Esther	1	Years 1 & 2

School information retrieved from *My School* (ACARA, 2018b) and shows 2017 data. Pseudonyms have been used to protect the identity of the schools and teachers.

Ridge Primary School. Ridge Primary School is situated in a suburb of Sydney and, at the time of data collection (2017), had an index of community socio-educational advantage (ICSEA) value of 1086, which is higher than the average value (1000). The students at this school comprised 81% from a language background other than English (LBOTE) and 1% identifying as indigenous.

This case study's mentee was Sally, a teacher who taught a composite class of Years 3 and 4 students (aged approximately 8–10 years). Her mentor, Allan, was also teaching a composite Years 3 and 4 class, and their classrooms were adjacent. Sally's class comprised 26 students, with three students on the autism spectrum and one diagnosed with attention deficit hyperactivity disorder. Sally reported that the diagnoses generally did not present any significant learning difficulties, but may have sometimes affected classroom management. Generally, her class was made up of approximately 80% students from LBOTE, with one student who was learning English as an additional language or dialect[2].

Hunter Primary School. Hunter Primary School is located approximately 90 km west of Sydney, and is classified as 'Inner Regional' by *My School* (ACARA, 2018b). At the time of data collection, the school's ICSEA value was 1063, which is higher than the average value. The students comprised 14% LBOTE and 3% identifying as indigenous.

The mentor for this case was Rob, who was teaching a composite class of Years 5 and 6. He was mentoring Angela, who was a newly appointed teacher teaching Kindergarten (aged approximately 5–6 years). Angela's class comprised 20 students. She reported that her students' parents and the school community were

[2] Students who have a Language Background Other Than English (LBOTE) speak another language at home. Students who are learning English as an Additional Language or Dialect (EAL/D) are those whose first language is a language or dialect other than English, and who require assistance in developing English proficiency (DoE, 2015).

active participants in her students' learning. As Rob and Angela were teaching students from different curriculum stages, their learning spaces were in different buildings. Rob was part of the information technology (IT) committee at the school, which managed, supported and encouraged technology use and integration across the school.

River Primary School. River Primary School is located in a suburb of Sydney and, at the time, had an ICSEA value of 1171, which is notably higher than the average value. LBOTE students comprised 29% of the school's student population.

The mentee for this case was Kelly, a teacher who was teaching a Year 5 class (aged approximately 10–11 years). Kelly was new to the school. Her first mentor, Andrew, was an existing assistant principal and another Year 5 teacher at the school, and left the school when he was appointed to a position at another school. After Andrew's departure, David came into the school as the new assistant principal and replaced Andrew as both the teacher for the second Year 5 class and Kelly's mentor. The participants' learning spaces were opposite each other. To accommodate the mentors' lesson observation of Kelly's lessons, the two Year 5 classes were combined, making a larger class of nearly 60 students. When David replaced Andrew as the mentor, he started the process without attending the pre-study meeting described in section 3.4.1, which would have provided him with detailed information on how to implement the professional learning model.

River Primary School had implemented a Bring Your Own Device, or BYOD, policy, where Stage 3 (or Years 5 and 6) students were encouraged to bring their own personal device. Such policies allow students to learn with devices with which they are familiar (New Media Consortium, 2013). Implementing this policy, Kelly's class incorporated a variety of portable devices, primarily laptops running the Windows and Mac platforms, and digital tablets running both iOS and Android. In the event that students' personal devices failed, a set of contingent iPads were available to the students. The iPads were located in an easily accessible place in the classroom, which students could take and use without the intervention of their teacher.

Edge Primary School. Edge Primary School is located 60 km northwest of Sydney and, although the school is outside the Greater Sydney area, it is classified as located in a major city by *My School* (ACARA, 2018b). The school's ICSEA value was 1030 in 2017, which was slightly higher than the average value. The school's student population comprised 7% LBOTE and 6% identifying as indigenous.

This case study's mentee was Debbie, who was a part-time teacher teaching a Year 2 class (approximately aged 7–8 years). Debbie's first mentor was Jennifer. Jennifer's motivation to adopt the mentoring role was to facilitate her achievement at the Highly Accomplished teacher accreditation level, while also facilitating Debbie's achievement at the Proficient level. Jennifer moved interstate after the second cycle, which resulted in Sarah adopting the mentoring role. Sarah was already serving as a mentor for Debbie in teaching literacy and adopted the mentoring role at Jennifer's request. At the time of the mentor change, there was also a change in school leadership, as there was a new principal starting in the role. Sarah engaged with the pre-study meeting process via a phone call with the researcher before engaging with her first cycle.

Tableland Primary School. Tableland Primary School is located approximately 75 km west of Sydney and, just as Edge Primary School, is out of the Greater Sydney area, but still classified as within a major city (ACARA, 2018b). This school in 2017 had an ICSEA value of 1020, slightly higher than average, and the student population comprised 9% LBOTE and 6% identifying as indigenous.

This case was unique, in that the mentor, Stuart, would have mentored two mentees, Ronda and Esther. However, due to a variety of reasons, as explained in Chapter 4, this case did not eventuate as planned.

3.4 Instruments

To collect the evidence for this study, a number of instruments were developed by the researcher and used by the participants. These instruments served two purposes. The first purpose was to collect data for this study. The second purpose was to act as draft versions for the toolkit, as described in Chapter 1. The intention was to improve these templates based on feedback from the participants. The versions of the templates seen at Appendix C are the final versions. The description of the feedback and refinement process can be found in Chapters 5 and 6. Other than the following instruments described in this section, data also examined included personal communications with the participants via emails and discussions, and documents that were not requested as part of the study but were sent through by the participants, such as lesson plans.

3.4.1 The framework

Studies from the literature underpinning the framework used in this study have been described in Chapter 2. The draft framework that was used by the participants can be seen in Figure 3.2. As indicated in the figure, the draft framework was based on the structures found in Beauchamp's (2004) and Sweeney's (2008) original frameworks.

	Stage 1 **Substitution**	Stage 2 **Supported**
File management and operating system use (OS)	Utilises some form of technology in classroom. (OS1a) Able to locate digital files and software for use in classrooms. (OS1b)	Uses third party teaching strategies, e.g. premade Notebook files, and lessons are lineal. Deviation from pre-planned content is not evident. (OS2a) Teacher sources references, materials and other supporting documents from other sources, e.g. collegial sharing on school server or on the internet. (OS2b)
Mechanical skills (MS)	Uses devices as presentation tools, such as projecting images through the projector only. (MS1a) Files created in lessons are saved, but not referred to (i.e. treated as separate lessons) (MS1b)	Students utilise devices to word process/write, highlight or drag. (MS2a) Limited utilisation of pre-made secondary software (e.g. Mathletics, Reading Eggs) (MS2b) Support images and other basic support documents are used only as decoration or peripheral support, rather than core instruments for driving lesson ideas. (MS2c)
Program variables (PV)	Lessons taught uses core tools of portable devices for their basic functions, i.e. camera in iPad to take pictures. However, tools used adds little to lessons (e.g. photos may be taken to record other learning and not used for lessons themselves) (PV1a)	Uses the core tools as before but now using as part of a lesson (e.g. pictures taken from camera may be used in a literacy lesson) (PV2a)
Classroom management and pedagogy (CMP)	Digital tools are only used by teacher. (CMP1a) Lessons are paced identically as to those without technology (CMP1b) Maintains eye contact with class. (CMP1c) Teacher presents information, and response from students is through questioning by teacher using the initiate-response-feedback model. (CMP1d)	Students' use of devices strictly planned by teacher and is restricted to technical features such as drag and reveal. (CMP2a) Used most commonly in teaching of core subjects (i.e. English and Mathematics) (CMP2b) Metalanguage of ICT is used naturally within lessons. (CMP2c) ICT is used to support text-based, teacher directed learning. (CMP2d) ICT is used as a reward for main learning. (CMP2e)

Figure 3.2. The draft framework

Stage 3 **Interactive**	Stage 4 **Advanced**	Stage 5 **Synergy**
Able to flip between different software, websites and other sources in support of lessons. (Multitasking) (OS3a) Teacher is familiar with premade teaching content and, as such, lesson pace is improved. This includes retrieving different information and support materials with ease. (OS3b)	Shares resources between students and teachers – e.g. collective media files, pictures, information. (OS4a) Teacher provides opportunities for students to share learning with authentic audiences (e.g. emailed to teacher/s for review, present at interactive whiteboard, video conference outside school environment, collaborative blogging). (OS4b)	Teachers and students share ownership of all ICT within the classrooms and share responsibility of using these technologies in classroom learning. Members of the classroom share their expertise with each other, mentoring each other on the use of ICT to enhance learning. (OS5a) Teacher is removed as expert or owner of ICT in the classroom and work as a mentor and facilitator for students in ICT uses. Students dictate the use of ICT across all curriculum (OS5b)
Students use ICT to assist with conceptual learning across Learning Areas. (MS3a) Uses a wider range of media sources (including Internet, digital camera and scanner) to accentuate curriculum and not for 'decoration'. (MS3b) Shares lesson ideas, media, files with others. (MS3c) Premade and saved documents acknowledge the continuation of learning and may be referred to in current and future learning opportunities. (MS3d)	Continued ICT use by students evidenced by student's confidence and natural use of technologies. (MS4a) Different technologies and a variety of their affordances are interwoven with curriculum learning. (MS4b) Learning is open ended and technologies are used to explore the direction that learning is taking. (MS4c)	Teachers and students confidently use known technologies together. (MS5a) Teacher and students explore further affordances of current and emerging technologies together. (MS5b)
Teacher takes opportunity to use different affordances of technologies experimentally and with increasing confidence to support the learning of the curriculum. (PV3a)	Complex and media-rich resources are collaboratively shared across networks (e.g. outside of school environment). Collaborative development of resources is evident across networks. (PV4a) Teachers develop strategies to enhance pace of lessons by using ICT affordances. (PV4b)	Authentic audiences and collaborative learning are evident in the learning space. Collaborative projects play a significant part of students' learning, which may include projects across groups, schools and countries. Students and teachers seek information from a variety of sources around the world, including experts in fields. (PV5a) Students, teachers and the greater learning community share in the learning of the students. The greater learning community has the opportunity to respond and add to students' learning. (PV5b)
Teacher initiates and plans opportunities for students to select ICT. (CMP3a) Uses ICT in a growing range of subject areas, including music, history etc. (CMP3b) The use of ICT is increasingly spontaneous and is used spontaneously in response to learning e.g. directing students to answer spontaneous questions using ICT. (CMP3c) Teachers experiment in blending ICT to differentiate learning and to support the development of literacy skills and of deeper knowledge and understanding. (CMP3d)	Use of revised and improved versions of previous lessons with emphasis on curriculum, rather than technical ability. (CMP4a) ICT is used successfully to sustain dialogue and to demonstrate learning. (CMP4b) Teacher uses online social networking to improve pedagogy and get teaching ideas. (CMP4c)	Teacher demonstrates an intuitive interaction with technology, which effects fluidity in lesson structure, including differentiation of lessons and assessment for, of and as learning. (CMP5a) Teacher and students have equal say to dictate the direction, momentum and scale of the lesson. (CMP5b) Independent reflection of learning includes ICT-rich tools. (CMP5c) Teachers, other educators and experts work collaboratively to share ideas, review lessons and develop new learning that synergistically blend a variety of quality resources, assessment tasks and activities. These emphasise the use of ICT in new, innovative and creative ways. (CMP5d)

The framework has been enlarged and made monochromatic in this figure.

In each domain and stage, explicit access points provided clear and defined behaviours for teachers to assess their current achievement and to decide on goals for future development. A shortened reference (e.g., OS2a) is made against each access point for easy identification within the framework.

As both Beauchamp's (2004) and Sweeney's (2008) frameworks targeted teacher skills when using IWBs, it was impractical for direct use and conversion when targeting technology integration skills for broader technology use. However, their structure provided a way to scaffold teachers' skills. The adaptation of the IWB frameworks' structures into a more comprehensive framework focused on two things:

- embedding a phased-in model in order to realise the beneficial affordances of technologies in education, as outlined in section 2.1.1
- adopting the other benefits of the reviewed frameworks, examined in section 2.3.

A number of beneficial affordances of technology in education were identified in section 2.1.1. Generally, these benefits focus on transitioning the foci of teaching and learning from the teacher to the student, and extending opportunities for student growth. As seen in the draft framework (Figure 3.2), the indicators move from Stage 1, where the skills outlined tend to be teacher-centric, to Stage 5, where the focus of most of the access points is to afford students with opportunities to learn and demonstrate their learning through the use of technologies. For example, two of the beneficial affordances of technology in education are to allow students to search and acquire new knowledge from beyond local resources (OECD, 2015) and to demonstrate their learning to a wider, global audience (Hazari et al., 2009). These benefits can be seen within the indicators PV5a and PV5b (in Stage 5, Program Variables) of the framework. This framework has been designed so that teachers and students can realise the benefits of technology in education as their perception changes and their skills to take advantage of their technologies' affordances grow.

To achieve this design purpose, the TPACK Framework (Koehler, 2017; Mishra & Koehler, 2006) was applied to the structures of IWB frameworks. As seen in the draft framework (Figure 3.2), the lower-staged access points reflect skills that isolated TK and PK, whereas those skills at the higher stages describe those that integrated the TK and PK into the TPK. It was decided that CK would not be targeted as this would vary based on the different learning areas the mentee teachers might choose to use, which would impact on their demonstration of TPK. For this reason, teachers' demonstrations of their TPACK, as will be seen in Chapter 4, were incidental. This exclusion of CK also acknowledged that the mentee teachers come from different and unique contexts, and contributed to an effort of overcoming one of the TPACK Framework's limitations, which was its lack of links to the context (McLoughlin, 2015). Adapting the TPACK Framework into the IWB frameworks also allowed the new framework used in this study to overcome the second limitation reported in section 2.3.1, which was the lack of practical application for the TPACK Framework (McLoughlin, 2015). By structuring the TPACK Framework into easily understood skill indicators, the new framework allowed the mentor teachers to provide contextual and practical advice to achieve the access points within the framework.

Another exclusion from the new framework was the use of the SAMR Model (Puentedura, 2015, 2016) in great detail. The criticism of the SAMR Model, described in section 2.3.2, showed that the stages of the SAMR Model cannot be reliably adapted into a developmental framework for teachers' skills when integrating technology. The benefits of the SAMR Model, that it is simple and straightforward (Hamilton et al., 2016), were already reflected in the structure of the IWB frameworks.

This draft framework (Figure 3.2) served two purposes during the study. Firstly, it created a way for the participants to reflect on the skill levels of the mentees. As described in section 3.5, the first use of this framework was for the mentors to assess the entry skill levels of the mentees. This allowed the mentoring partners to establish a benchmark from which the skills of the mentees could be developed. By tracking the potential areas for development in the mentees' skills against the framework, the participants were able to ascertain the next steps and the appropriate strategies in order to develop the mentees' movement upwards in the framework. Similarly, the mentors assessed the exit skill levels of the mentees, in order to determine growth. An analysis of this growth across the cases allowed the researcher to determine the efficacy of the framework, as a measure, and the professional learning model, as a way to support the mentees' development. This type of analysis followed the second layer of an interpretivist analysis position, as described in section 3.1, allowing the researcher to assess the efficacy across the cases. It also allowed him to identify and acknowledge the variations that affect the framework's effectiveness, consistent with a pragmatic research position.

As described in section 3.5, the researcher visited each school and was in communication with the participants. These interactions provided opportunities for the researcher to both support the participants as they engaged in the professional learning process and data gathering, and to discuss with the participants their perception and feedback of the toolkit, including the framework. These perceptions and feedback, combined with the participants' engagement with the overall toolkit, formed specific findings that were used to inform the refinement of the toolkit as a whole. Specifically, this provided a way for the draft framework (Figure 3.2) to be refined. To allow for this framework to be used by more schools, only the common feedback and findings, discussed in Chapter 5 and summarised in Table 6.1, were adopted for refining the toolkit. This allowed the researcher to action the necessary refinements described in section 6.2 to produce the final version of the framework, seen in Figure 6.1 and found at Appendix C.

3.4.2 Lesson Observation Field Notes template

The Lesson Observation Field Notes template, or Field Notes Template, (Appendix D) was not a requisite instrument for this study. It was emphasised to the participants during the pre-study meeting that mentors could use this as a guide or a tool. Although field notes taken by the mentors during the study were not required to be entered into this template, mentors were requested to submit their field notes for analysis with the other data. The template was designed so that the field notes would provide a way to support the mentors when discussing the observations with their mentees.

It is important to note that approximately half of the teachers (47–54%) in Aubusson et al.'s (2015) study reported that they considered lesson observations as helpful. Aubusson et al. (2015) hypothesised that some teachers considered lesson observations as daunting, with a stigma that it was a method of judgement and scrutiny, assessing the quality of their teaching, rather than as a way to facilitate professional development. Whereas Aubusson et al. (2015) considered that this ill-feeling was not important for peer observation, they nevertheless suggested that practitioners needed to consider its implication on professional learning.

3.4.3 Recording Tool

To assess the progress of the mentees, a Recording Tool (Appendix E) was used to date and mark the entry and exit levels of the mentees. Every access point in their shortened reference form was included in the Recording Tool to provide an easy way for the mentors to track the progress of their mentees.

It was initially intended that mentors would record the mentees' progress on the Recording Tool sequentially, so that the mentee's achievement could not be marked in a higher stage in a single domain of the framework without achieving all prior access points. However, findings from Hunter Primary School, as will be seen in Chapter 4, provided compelling evidence for changing this approach to allow mentors to mark achievement at any stage of the framework, and use the identified gaps as targets for mentee growth. Subsequently, instructions at the latter pre-study meetings, as will be described in section 3.4.1, reflected this change.

3.4.4 Review Form

The Review Form (Appendix F) was designed for use during the reflection meetings. It provided a structure for mentors and mentees to discuss the observed behaviours during the lesson, and then note the milestones that were to be achieved by the following observation. The milestones were drawn from the access points in the framework. In order to make skill development more manageable for the mentee, it was emphasised to the participants that no more than five milestones should be selected for each cycle. Wang et al. (2014b) explained that such a scaffolded approach to professional learning provides a manageable way for teachers to translate learned skills into student learning experiences. They found that smaller and achievable tasks allowed teachers to build confidence in using these new skills before adopting others.

It was explained at the pre-study meeting that the strategies aligned with each milestone should be negotiated between the mentor and mentee, drawing from their combined knowledge and understanding of the context, as well as the mentor's expertise.

3.4.5 End-of-Study Survey

In action research studies such as this one, the immediate reactions to the recent lesson observations and aspects of relationship between the participants can affect their interpretation of the data (Stake, 1978). The survey provided a way for participants to reflect independently on the study and the templates later, at a point in time when immediate reactions, emotions and the relationships are less likely to impact on their reflection.

Bryman (2008) also noted that the survey method has a number of limitations, including:

- the respondent may attribute different meanings to the questions or miss key terms in the questions
- the respondent's responses may not match their actual behaviour and feelings
- the respondent may not always remember certain occurrences or behaviours.

To mitigate the first two limitations, the data from the survey were used to identify common and conflicting information when analysed with the other data. To mitigate the third limitation, where the participants may encounter difficulties in recalling aspects of the study should too much time elapse between the end of the study and when the participants respond to the survey, the participants were requested to complete the survey shortly after their case study completed.

The construction of the survey followed Stringer's (2008) survey design criteria, emphasising the consideration of:

- structure
- purpose
- questions
- response formats.

The structure of the survey grouped questions together in a logical system that allowed the participants to reflect on the study, including the framework, templates and the mentoring structure. The delivery system of the survey was through *Qualtrics*, as the preferred system by the University of Tasmania. Skip logics were used to target questions to the appropriate type of respondent.

The questions were created specifically to ascertain participants' experience with the study, the framework and the templates. Primarily, the questions in the survey were closed-ended, allowing greater regularity across the responses (Babbie, 2016). These close-ended questions included binary questions, that is allowing for yes or no responses, and Likert scales, allowing respondents to rate their attitudes or perceptions (Vogt & Johnson, 2016). Odd-numbered scales allow respondents to 'sit on the fence' (Brown, 2001) and, therefore, any scaled questions in this survey ran on a four-point scale. Open-ended questions were also available to provide participants with opportunities to expand on and explain their quantitative responses. The open-ended questions were used to overcome the shortcomings of using only close-ended questions, which might not allow the full range of possible responses (Babbie, 2016) and might present data that misconstrue the respondents' intentions, meanings and values (Kemmis & Wilkinson, 1998).

Babbie's (2016) suggestions for best practice when designing survey questions were also considered. These included ensuring questions:

- were relevant
- were short
- avoided negative or biased items and terms
- avoided double-barrelled questions.

The content of the questions was informed by the initial review of literature, which identified the factors that contribute to effective professional learning, mentoring and integration of interactive technologies. These questions aimed to provide both additional data regarding participants' experience, and triangulation with the qualitative data gathered through the meeting recordings and the completed templates.

The survey was designed for online delivery. The survey, describing the questions and their intended type of respondent, is included as Appendix G.

3.5 Procedures

The study was conducted in a similar way for each of the five cases. Contextual factors influenced the way in which the professional learning model was implemented at each school. These factors are discussed alongside the relevant themes and categories in the following chapters. It was intended that all cases would draw data from six cycles of lesson observations and meetings. This length of time was chosen to balance the imposition on teachers' time and effort in this study with the need to collect sufficient data to reliably report the findings. Based on this balance, and the examples from the literature, it was considered that the six cycles would be sufficient time for teachers to see evidence of growth. However, most schools were unable to complete the six cycles, and the impact of this change in duration on teachers' growth is further discussed in section 5.3.1. This did not appear to form a limitation, as the study still yielded adequate data, as seen in Table 4.1. The intended and actual timeframe in which the studies were conducted is outlined in Table 3.3.

Table 3.3

Timeframe and duration of the case studies

Case studies	Intended timeframe	Actual timeframe and duration
Case 1 Ridge Primary School	Terms 1, 2017	Terms 1 and 2, 2017 (3 cycles)
Case 2 Hunter Primary School	Terms 1, 2017	Terms 1 and 2, 2017 (6 cycles)
Case 3 River Primary School	Term 4, 2016	Terms 2 and 3, 2017 (5 cycles)
Case 4 Edge Primary School	Term 2, 2017	Terms 2, 3 and 4, 2017 (5 cycles)
Case 5 Tableland Primary School	Term 2, 2017	Did not start

A pilot case study (Case 3) was initially planned by the researcher and his supervisors in order to gather feedback on the templates and the professional learning model. The feedback would have allowed for some initial changes to the learning model and templates, prior to retesting these in the other schools. However, due to late responses from principals and participants from across the schools, and participants starting their first cycles later than anticipated, it was considered more beneficial to maintain, as closely as possible, the integrity of the timeline, which was intended to end data gathering in Term 2, 2017. Despite this alteration, the timeframe for the studies, as seen in Table 3.3, extended until the end of Term 4 for Edge Primary School, due to the sudden departure of their first mentor. For a variety of reasons, as seen under Case 5 in Chapter 4, Tableland Primary School did not complete any part of the study. Each case study’s processes, including the data-gathering processes, are outlined below.

3.5.1 Pre-study meeting and preparation

Each case study started with a pre-study meeting to prepare the participants for the study. All pre-study meetings were conducted face-to-face with the researcher, with the exception of Sarah, the mentor from Edge Primary School, which was conducted over the phone. The meeting provided an initial opportunity for participants to understand the study, as well as to ask questions and clarify any issues. Action research requires all participants to understand the division of labour (Mattsson & Kemmis, 2007) and, therefore, the meeting provided participants with information about:

- the schedule of the study
- how to use the instruments
- the process of the study
- how to forward the data to the researcher
- how to contact the researcher for support.

To assist the mentors with the reflection meetings, at the request of the deputy principal (DP) from Ridge Primary School (Case 1), a set of generic questions was provided shortly after the first pre-study meeting, which was later available to all other schools. Instructions were provided explaining that these questions would serve as a starting point for the participants' discussions. These questions were:

1. During the lesson, what did you see?
2. Why do you think that happened?
3. (To the mentee) Would you like to change anything for next time?
4. (To the mentor) Any immediate feedback on the mentee teacher's actions?
5. Has anything happened during the day that might have affected the level of success in ICT integration during this lesson?

Prior to the first lesson observation, each of the mentors was asked to study the framework closely to gain a good understanding of the progression of learning. If the mentors required clarification regarding the framework, as well as the professional learning model, the mentors could seek assistance from the researcher at any time. Once the mentors understood clearly the professional learning model and the framework, they observed their mentees' first lesson.

In an effort to mitigate the potential problem of stigma associated with lesson observations in this study, emphasis was made in the pre-study meetings that the purpose of the observations was not to judge performance but rather to engage the teacher in capacity building. Additionally, this issue was considered during the data analysis.

3.5.2 The Action Research Cycles

This section outlines the cycles that were implemented in each case study.

Cycle 1: Initial observation, benchmarking and planning

After the observation, the mentor and mentee met to discuss the lesson's occurrences. Together, they decided on the entry level of the mentee's skills based on the framework and recorded this on the Recording Tool. From here, the mentor and mentee identified up to five milestones for the mentee. These milestones were drawn from the access points in the framework. To meet these milestones, the mentor provided advice and negotiated appropriate strategies with the mentee to use in practice.

Cycles 2–5: Standard cycles

These subsequent cycles continued the action research process. In an effort to achieve the agreed milestones, the mentees would implement and trial the suggested strategies and advice. Another lesson observation was scheduled and the mentor once again observed a lesson presented by the mentee. The process of observing the mentee, discussing the lesson observation and selecting milestones was repeated. Participants were encouraged to revisit milestones in the following new cycle if these were not achieved in the previous cycle.

Every reflection meeting was audio recorded. These recordings were sent to the researcher after the meeting for transcription and analysis. When the transcripts were made available in *CloudStor*, a cloud storage system that is endorsed by the University of Tasmania, participants were asked to check the transcripts to ensure accuracy, allowing for increased reliability of the data. To ensure a better understanding of the process being played out in each unique context, the researcher visited each school once, towards the middle or end of the case studies, to observe a lesson and a reflection meeting. To maintain the integrity of the process, the researcher remained as an observer, but took the opportunity to clarify observations and discuss with the participants the enablers of and barriers to the process and the use of the instruments. Notes of these discussions were collected, and used as part of the feedback and results from the study.

Cycle 6: Post-study assessment and online survey

As a final step of the study, a reflection meeting was conducted in a similar way to the first cycle. The participants recorded the mentee's newly achieved capabilities on the Recording Tool. As part of the reflection process for the study, each participant was sent a link to the survey, which they completed independently.

3.6 Data analysis and reliability

Consistent with a critical constructivist approach, it was expected that participants could provide insight into the results from their particular case through the lens of their contextual understanding. In the action research model, participants were encouraged to provide initial analyses of the data based on why certain behaviours and actions were observed. This is also consistent with a pragmatist research approach, where it is assumed that each case, despite their contextual differences, presents realities which are as authentic as each other. Elements of this initial analysis can be found in both the reflection conducted by the participants, as well as directed discussions with the researcher. This form of analysis can also have limitations. Participant analyses are constrained by the context and can be subject to certain biases (Lincoln & Guba, 1986). The researcher can bring along insight and skills that those without research experience lack (Babbie, 2016). Therefore, as recommended by these authors, a form of collective analysis of the data took place. While the participants brought their contextual understanding to an initial analysis of the data, the researcher, as an impartial observer, was able to identify the common and discrepant emerging themes and factors across the cases. This form of analysis complements Kemmis and Wilkinson's (1998) assertion, as described in section 3.2.1, that participatory action research as a process dialectically relates the subjective, as seen here in the participants' initial analyses, with the objective, through perceiving the behaviours externally by the mentor and considering the behaviours across the cases.

In this particular study, the process during the reflection meeting allowed the participants to consider and analyse the actions during the observed lesson, and provide contextually-based rationale for these actions. These reflection meetings were recorded and allowed the researcher to determine common and discrepant features from across the cases, as well as allowed him to develop an understanding of each school's context. This understanding was triangulated with his observations and discussions during the mid-study visits. The combination of the subjective, such as the reflections by the participants, and the objective analysis that the researcher was able to provide from the data across all the cases, will improve the credibility and validity of the data (Schwandt et al., 2007).

While it is sometimes argued that qualitative research lacks the scientific rigour of quantitative research, terms such as reliability and validity can still be aptly applied to qualitative research (Noble & Smith, 2015). In qualitative research such as this, validity can refer to how the findings represent the data. The findings from the study need to accurately outline the perceptions and perspectives of the participants, while acknowledging any biases that may have emerged. In reference to reliability in qualitative research, there needs to be consistency in both the methods of data gathering and analysis (Noble & Smith, 2015). In this study, reliability referred to the ability to replicate the data-gathering and analysis methods across the cases. In order to increase the study's credibility, a number of criteria for data reliability and validity, as outlined by Lincoln and Guba (1986), were considered and integrated into this study's design.

Prolonged engagement and negative case analysis. Each case was intended to run over six cycles. This time period allowed participants to identify and explain behaviours, as well as to reflect on the behaviours of each individual observation and, in addition, to review those from across different lessons. Also, the cases ran over four school terms, allowing the researcher to discover the different features evident across the cases.

Despite the fact that most cases did not complete the six cycles, this did not impact on data reliability. The methods produced similar results from each case study, as seen in Chapter 4.

Persistent observation. There were two foci for mentor teachers to target in their observations. In the initial and concluding observations, the mentor used the framework as a 'checklist' to identify mentee teachers' level of integration. The other lesson observations, in cycles two to five of each case, focused the mentors' observations on the mentees' attempts to achieve the milestones. In addition to other benefits, as indicated in section 3.4.4, limiting the number of milestones to a maximum of five ensured the lesson observations were more manageable, so that the data collected remained valid, and provided more opportunities to reveal detail and depth.

Triangulation. A number of different data sources were used to provide both the narrative and to assist in identifying the interrelationship of common features and factors that affected the framework's implementation and the delivery of the professional learning. Claims were not made without due consideration of multiple data sources, these included:

- transcripts of the reflection meetings at each case, which provided an independent lens on the context and activities
- records from lesson observations, including the completed templates

- observer notes, from the mentor and, during the mid-study visits, from the researcher
- communications between the researcher and the participants
- independent surveys.

This cross-verification from multiple sources facilitated the validity of the data, as it enabled the researcher to test the consistency of findings using the different instruments and methods. These multiple sources enabled the researcher to code common features across the data sources, and identify alignment and inconsistencies, which are outlined in the following chapters.

Member checks. There was ongoing communication between the participants and the researcher. Discussions occurred either face-to-face or via email. In order to maintain data reliability, discussions with the participants allowed the researcher to clarify any ambiguity in the transcripts and ensured that the analyses of the data reflected the intended meaning. Participants were also provided opportunities to review the data and the transcripts of the recordings of the reflection meetings when these were made available in *CloudStor*. These member checks with the participants helped to establish the accuracy and reliability of the data.

3.7 Instruments for analysis

As initially mentioned in section 1.3, and then further elaborated on in section 3.1, this study adopted as its epistemology the constructivist theory. Thematic analysis within a constructivist position does not seek to focus on why the actors within a reality are motivated to act in certain ways, but rather theorises those factors and social-cultural constructs that enable the social behaviours of each actor within their unique contexts (Braun & Clarke, 2006). This approach allowed the researcher to understand the experiences of the participants within the specific realities of the five case studies, which are reported in Chapters 4 and 5, and aligns well with the mentioned understanding that case studies are not bases for generalisation (Mattsson & Kemmis, 2007; Shulman, 1986). When analysing the data, the researcher collated, refined and defined themes and categories by:

- framing the themes and categories in order to address the research questions
- considering those themes and categories that already exist within the literature
- forming a coding hierarchy, in alignment with the constructivist theory, that groups and structures the factors and social-cultural constructs which affected the participants' and their students' behaviours and actions.

To achieve these three points, analysis of the data in this study followed the phases of thematic analysis as described by Braun and Clarke (2006). A summary of the alignment between these phases and the way in which data were analysed in this study is seen in Table 3.4. The phases and analytic processes described in the table are only broadly chronological, as Braun and Clarke (2006) explained that this form of analysis is more a recursive process where the researcher may move back and forward along the phases as required.

Table 3.4

Phases of thematic analysis alignment in this study

Phase of thematic analysis		Analysis process in this study	Example applications (where appropriate)
1	Familiarising yourself with your data	▪ The researcher transcribed initial audio recordings and noted down initial ideas.	
2	Generating initial codes	▪ The researcher and his supervisors coded transcripts.	Samples from transcript: "We're still trying to go from, "Here's a book and yes, you can use an iPad as a book … you don't want to make it superficial … " (Extract also seen on p. 144) Coded as 'Explaining' "Instead of having a document where they're all accessing and putting my [one] passive voice, you could have passive voices … it's sort of like a noticeboard that scrolls on the board itself." (Extract also seen on p. 162) Coded as 'Providing strategies'
3	Searching for themes	▪ The researcher collated the codes into potential themes. An initial coding hierarchy was developed.	For example, in one transcript: 154 separate codes emerged. E.g., those codes mentioned above, 'Explaining' and 'Providing strategies', were considered under 'Mentoring skills'.

Phase of thematic analysis	Analysis process in this study	Example applications (where appropriate)
4 Reviewing themes	▪ The researcher and his supervisors discussed the coding, ensuring agreement across the coders.	Initial codes from three coders: Coder 1: 'Mentor support' Coder 2: 'Mentor/mentee relationship' Coder 3: 'Mentor guiding' Final code: 'Mentor/mentee relationship' (parent code); 'Mentor support' (child code)
	▪ The researcher reviewed previously coded transcripts, as new codes were developed.	'Evidence of SAMR' was discarded. Recoded as 'Evidence of TPACK' (Parent code)
5 Defining and naming themes	▪ As more transcripts were coded, codes were refined and defined. ▪ Names of codes were defined through both discussions between the researcher and his supervisors, and ongoing analysis. The theme names were used in the reporting process.	'Mentor TPACK' and 'Mentor reinforcement' became children of the parent code 'Mentor skills' As a result of coding all the transcripts: All codes, as seen in Appendix H, were refined, grouped and renamed into: ▪ four parent codes ▪ 22 child codes ▪ 45 grandchild codes ▪ 67 themes.
6 Producing the report	▪ The defined themes were presented in a structured and systematic way to narrate each case, as seen in Chapter 4. ▪ The thesis related the analysis to the research questions, as seen in Chapter 5. ▪ Purposefully chosen extract examples were used to provide evidence for the themes and for the analysis, as seen in both Chapters 4 and 5.	The final code hierarchy outlined in Phase 5 and seen at Appendix H was used to report on the findings under each case (in Chapter 4) and the research questions (in Chapter 5).

The four parent codes, as described under Phase 5 in the table, formed the broad categories in Chapters 4 and 5 under which the findings were grouped. The subsequent child codes, grandchild codes and themes were then reported under these categories.

To conduct the analysis process described in Table 3.4, two significant tools were used as part of the analysis of the data. As the study was primarily qualitative, it generated a significant amount of qualitative data. The data were imported into *NVivo*, a software tool by QSR International, designed specifically for qualitative data analysis and coding. Coding is considered a key strategy for action research data analysis (Ary et al., 2014). Coding is a form of qualitative data processing and allows the analysis to categorise data so that concepts can emerge (Babbie, 2016).

To implement a quality assurance feature into the analysis process, multiple transcripts were coded independently by the researcher and his supervisors. The repetition of this process of analysis ensured that it was reliable; the researcher and his supervisors repeated the analysis of the same transcript to ensure that others would come to the same conclusion. The iterative process also increased inter-coder reliability, as the process ensured increased agreement between the coders, as each transcript was coded and any new coding protocols were agreed. The process also provided evidence of data validity, as this way of analysis allowed the researcher and his supervisors to corroborate each other’s coding. The following describes the steps in which the qualitative analysis was completed and aligns with Phases 2 to 5 as seen in Table 3.4.

1. The researcher and his supervisors each open coded one transcript independently, establishing codes in factors identified in Chapter 2, following a deductive manner of analysis, and by allowing new themes to emerge, as in an inductive method of analysis, that were grounded by their experience as educators.

2. The researcher collated the coding, identifying areas of disagreement. The researcher and his supervisors conducted a thorough discussion of these areas, and agreed upon a final code for each of these areas.
3. The researcher used the codes following the discussion and analysed a second transcript. New codes were established using protocols from the initial discussion. Completing the analysis, the researcher created a codebook to be used by his supervisors, who also analysed the second transcript using the codebook.
4. Areas of disagreement were once again discussed, and new protocols for analysis and coding were established.
5. The researcher used these protocols and the established codes to analyse all other transcripts. No additional coding issues were identified in the analysis of the remaining transcripts.

The final codebook, as described in steps three and four above, can be found at Appendix H. An extract of this codebook can be seen in Table 3.5. While the parent and child codes were mostly identified from the literature reviewed in Chapter 2, the grandchild codes and themes generally emerged as nuances specific to the case studies.

Table 3.5

An extract of the codebook

Parent	Child	Grandchild	▪ Themes
Impact on mentee integration	Mentee skills and attitudes	TK	▪ Limited ▪ Overcoming limitations ▪ Knowledge of tech
		PK	▪ Reinforcing learning ▪ Understanding student skills ▪ Explicit instructions ▪ Differentiation

Parent	Child	Grandchild	Themes
		TPK	▪ Teaching moments ▪ Classroom management ▪ Scaffolding learning ▪ Combining tech ▪ Revisiting learning ▪ Integrative/Supportive ▪ Student groupings
		TPACK	▪ Community supporting T & L using tech ▪ Combining tech, content and pedagogies

The quantitative data collected in *Qualtrics* were analysed within the software, using the software's tools for data analysis. The data were collated by the software and presented in a variety of different visualisations, such as tables and graphs, that allowed for clear interpretation of the data. Survey data, including both quantitative and qualitative elements, are presented in Chapter 4 under each case study with the other data.

3.8 Research conduct

To ensure ethical conduct during the research and the data analysis, a series of considerations was made. These included informed consent, confidentiality, recordings of meetings and the dissemination of findings.

Informed consent. Informed consent was gained from all participants. The mentors and mentees were positive volunteers and were considered as primary participants, as they worked directly with the researcher and were the primary focus of the study. Secondary participants were the students, as their actions may have been recorded as a result of teacher action and class proceedings. Any non-participating student was not disadvantaged, as they continued to participate in their learning but was removed from any data gathering. Consent was also gained from principals and parents. Personalised information statements and consent forms for the mentee teacher can be found at Appendices I and J respectively. Variations of these documents were distributed to the mentor teachers, parents, students and principals. All participants had the right to withdraw and were informed through their personalised information statements. Principals and teachers were also informed of their right to withdraw through their initial contact with the researcher and during the pre-study meeting.

Confidentiality. Confidentiality of all participants and schools was strictly maintained. Any identifying information has been removed from this thesis. Students were never identifiable by the researcher, as participating teachers were asked to remove students' identities from the data prior to it being sent. Any non-participant's name noted in the data was removed and replaced with a generic reference, e.g. Teacher. Similarly, pseudonyms have been used for all direct participants and schools.

Recordings. All meetings were audio recorded and uploaded to *CloudStor*. Some recordings were transcribed by the researcher, so that he could gain familiarity with the data. Others were transcribed by *TranscribeMe*, which was done to provide efficiency during the data analysis, and a confidentiality statement was included in the transcribing agreement. Participants were able to view and modify the transcript to ensure accuracy. Recordings were transcribed as soon as possible so that contextual and non-verbal cues were not forgotten by the participants (Silverman, 2013).

Dissemination of findings. The thesis will be available online from the University of Tasmania. A link to the digital thesis will be sent to the DoE as part of the SERAP requirements. Other ways of disseminating the findings will include:

- a 2-page summary document sent to the DoE as part of the SERAP requirements, and to the participants and the current principals of the participating schools
- the toolkit, as seen in Appendix C, which will be available for schools to use, and includes a summary of the findings implicit to the professional learning model, the framework and the supporting templates
- possible paper submission and presentation at future academic conferences, and contributions to scholarly journals.

3.9 Summary

The purpose of the research was to ascertain the factors and features that influenced primary teachers' integration of interactive technologies and how these interacted with a structured professional development process. However, it was also important that the study provided authentic practical benefits for the study participants. Thus, it is anticipated that the professional learning model, framework and supporting templates summarised in this chapter will be formed into a toolkit for teachers to use in building their capacity when integrating interactive technologies.

This chapter has described the design of the study, the instruments and processes used to gather evidence, and the process used to analyse the data. The framework, mentoring structures and instruments were examined using the participants' perceptions, application and interpretation of the toolkit developed within the study. This examination assisted in addressing the research questions, and allowed the researcher to develop an understanding of best practices when implementing the toolkit and the features of the toolkit that needed refinement. Finally, the chapter has considered the processes used to support reliability and validity of the data, and consider some potential limitations which will be reassessed in Chapters 6.

CHAPTER 4
THE CASE STUDIES

This chapter presents the findings from each of the cases outlined in Table 3.2. The anticipated data from each case were outlined in Table 3.1 and the actual data received from each case are summarised in Table 4.1.

Table 4.1

Received data from each case study

Case study	Type of data	Number received
Case 1 *Ridge Primary School*	Audio recordings	3 Total duration: 13m 33s
	Field Notes Templates	3
	Review Forms	2
	Recording Tools	1
Case 2 *Hunter Primary School*	Audio recordings	5 (Notes regarding the sixth observation were sent by email from the mentor.) Total duration: 1hr 18m 30s
	Field Notes Templates	7
	Review Forms	5
	Recording Tools	6
	Other	Lesson plans: 5
Case 3 *River Primary School*	Audio recordings	6 (Includes two recordings of the participants' planning the lessons. Notes regarding the fifth reflection meeting were sent by email from the mentor.) Total duration: 1hr 14m 34s
	Field Notes Templates	2
	Review Forms	0
	Recording Tools	3
	Other	Notes from planning: 1 Student activity sheets: 4

Case study	Type of data	Number received
Case 4	Audio recordings	5
Edge Primary School		Total duration: 53m 14s
	Field Notes Templates	3
	Review Forms	0
	Recording Tools	2
	Other	Lesson plans: 6 Student activity sheets and templates: 4

Data such as conversation notes and emails are not included in this table. Data that were not entered into the intended templates are classified as those templates.

Data received were affected by the number of cycles in which the schools were able to engage, as seen in Table 3.3.

A critical constructivist approach requires participants to be part of interpreting their own realities (Kincheloe, 2005). By both adopting this and an interpretivist analytic stance, as described in section 3.1, the evidence in this chapter shows the participants discussing and reflecting on the social behaviours from the observed lessons, as well as allowing the researcher to analyse the data across the cases. This latter analysis process, as described in Phase 6 within Table 3.4, grouped the findings into four broad categories, which are organised in this chapter as:

- mentor-mentee relationship
- factors that influenced the mentees' integration of interactive technologies
- factors contributing to the study's model of professional learning
- the impact of the professional learning model and feedback on the toolkit, which includes the professional learning model, framework and the supporting templates.

The more detailed factors and themes that emerged from the analysis will be considered within each of these categories. The categories, and these more detailed factors and themes, emerged from the literature review in Chapter 2 and the analysis process, as described in section 3.7. Themes, as they are presented in this chapter, are elaborated on from those found in the codebook (Appendix H).

The findings detail different ways in which the professional learning model was implemented and how the unique context of each case impacted on the implementation of this model.

Excerpts from the transcripts in this chapter have been chosen to provide evidence against the specific categories and themes. In most cases, each excerpt is one instance of many examples available throughout the transcripts. Also, some excerpts may provide evidence for multiple categories or themes. However, to ensure there are diverse examples, a variety of excerpts have been chosen to represent the different categories and themes.

Figures in this chapter are scanned copies of the templates used by the mentors to track mentee growth. The clarity of these figures may have been affected by the mentors' scanning processes. All figures in this chapter have been added to indicate the level of mentee skills throughout each case study. Therefore, in general, the text within these figures are not intended to be read, but can be compared with the draft framework at Figure 3.2.

Case 1: Ridge Primary School

As outlined in section 3.3.3, Ridge Primary School is a large school in one of Sydney's suburbs. The mentor chosen for this case was Allan, who was teaching a Year 3 and 4 composite class. Allan was mentoring Sally, whose classroom was adjacent to his own and who was also teaching Year 3 and 4 students. Allan and Sally completed three cycles of the model, during which Sally focused her technology integration into the Science and Technology key learning area. Despite their best efforts to continue with the professional learning model, after the third cycle Allan emailed explaining they could not continue. At the conclusion of their involvement, Allan and Sally completed the survey and forwarded all documentation through to the researcher.

4.1.1 Mentor-mentee relationship

The three action research cycles showed change in the mentor-mentee relationship as the process progressed. These changes were revealed in the interactions between Allan and Sally during the reflection meetings.

Allan's commitment to support Sally was evident throughout the three reflection meetings, as well as during the lessons. As part of the support, Allan provided Sally with in-lesson support, which took the form of addressing technical issues and assisting students to complete tasks. Evidence of these actions was recorded in field notes from the researcher's observation during the mid-study visit [May 18, 2017]. Another source of data for Allan's in-lesson support was Sally's recounting of the first lesson, where she described the benefits of having two teachers assisting the students.

> And yourself was also in the classroom and if I did need extra help working one-to-one with a child, putting their username and login, having two teachers was quite handy.
>
> [March 2, 2017]

Other evidence of Allan's support was seen in his feedback, encouragement and advice. Support of this nature was more common during the third reflection meeting. The first excerpt below reveals the single piece of evidence for this support found during the first meeting.

> It was structured well. Great use of instructions. Students were focused. There was a lot of time given and a lot of demonstration, which worked out really well. Teacher walked around the room giving students extra support and the use of the buddy system was very useful.
>
> [March 2, 2017]

The second excerpt provides an example from the third meeting, where feedback, encouragement and advice were more frequent.

Allan:	So you wouldn't have been able to fix it [student laptops]?
Sally:	No.
Allan:	So you would have been down to six?
Sally:	Yeah [laughter].
Allan:	Which would make it a little tricky.
Sally:	One between five kids or four kids [laughter].

[May 18, 2017]

4.1.2 Factors influencing Sally's integration of technology

This section gathers together evidence of the factors that influenced Sally's integration of technology. The two factors evident from Ridge Primary School were Sally's skills and her access to technology.

Sally's skills

Section 2.3.2 described why the SAMR Model was highly criticised by some scholars. For this reason, the TPACK Framework, as described in section 2.3.1, was chosen as a way to measure the mentees' skills across the schools. At Ridge Primary School, the transcripts indicated Sally's skills, measured against the components of PK and TPK.

> So it was just, never done it for a little while, seeing them do it, and getting to do it again and reminding them actually how to write an email. (Reinforcing student learning, PK)
>
> [March 9, 2017]

> So, yeah, some of the laptops weren't working. So we had to – well, Allan had to go and get a laptop from his room. And we had to just sort of take a few moments to get the kids on the laptops and with them turned on. (Managing students' access to learning amidst technical difficulties, TPK)
>
> [May 18, 2017]

A second source of evidence of Sally's skills came from Allan's field notes. These field notes revealed evidence of Sally's PK. An example of these notes is:

> Establish routines, clear instructions (Providing explicit instructions to students, PK)
>
> [March 2, 2017]

Access to technology

This factor relates to the mentee's and their students' access to reliable and relevant technologies. Reliability of the technology is defined as both the usability of the technology by the teacher and the students, as well as its ability to connect with the school network, infrastructure and internet. The case at Ridge Primary School presented numerous references to this factor in each cycle. The example below shows one of the references, where Sally described the failure of laptops during her lesson.

> Again, mainly the computers. The lack of. We did happen to get a few more computers for this lesson. However again some of them were just freezing or unable to work.
>
> [Sally, March 9, 2017]

These extracts provide evidence for factors that influenced Sally's integration of technologies, including her skills in line with the TPACK Framework.

4.1.3 Factors contributing to professional learning

This section provides evidence of factors that influenced the implementation of the professional learning model. These factors are organised by mentor capacity, and educational system and school leadership support.

Mentor capacity

Mentor capacity is divided into two themes. The first theme relates to Allan's expertise when integrating interactive technologies. As with section 4.1.2, Allan's expertise is measured against the TPACK Framework. In a conversation between Sally and the researcher [May 4, 2018], Sally revealed that Allan was previously the computer coordinator, which required him to have TK. The excerpts below show Allan's PK and TK.

> You can sit with the ones with the most trouble on the floor and have an extension task for the ones that know already what they're doing.
> (Discussion on how to support students' learning, PK)

Sally: And I did have to get around and help them log in. And some of them just weren't logging in. I couldn't even log them in. So that's hard.

Allan: That's where you need a blue cable.
(Using alternative methods to overcome technical difficulties, TK)

[Both excerpts from May 18, 2017]

Allan's mentoring capacity is also shown in the different strategies he used to develop Sally's skills when integrating technologies. For example, Allan used questioning strategies to elicit responses from Sally during all three reflection meetings. This strategy is exemplified in the first reflection meeting, where Allan requested Sally to reflect on the lesson:

> Why did you think the lesson went so well then? How did you make it go?

[March 2, 2017]

This form of questioning was evident in both the first and second reflection meetings. In response to Allan's questions, Sally recounted the behaviours and actions from the recently observed lesson. The extract below is from the second reflection meeting, which illustrates the form of recounting seen in both reflection meetings. *Collaboration*, as mentioned in this and later excerpts, refers to one of the school's network drives.

> The second lesson was a lot smoother than the first lesson … So, to start with, for this lesson I just did … we started off, or I started off, with a recount of lesson one. This was particularly useful for anyone who wasn't there in the first lesson. I did spend a little bit more time with these students … Some of them could remember how to access their email but didn't know how to compose an email … then the focus of the lesson was students creating a *Word* document. So, again, I modelled and scaffolded out the front how [to] open *Word* processor … So, explicitly modelling how to find Start menu, search for *Word* if it wasn't in the recent program list … I gave the students some things they had to type out. And this was in certain colours, underlined, and things like that … Then I showed the students how to save that file to *Collaboration* which is a … part of the internet in our school … So, basically, by end of the lesson I witnessed Allan and myself walk around, getting everyone to open *Word* processor and saving a file.
>
> [Sally, March 9, 2017]

This recounting changed into a form of reflection conducted collaboratively between Allan and Sally, as the third meeting evidenced interactions between Allan and Sally that were more conversational.

Allan: Would you change the buddy system you had?

Sally: Oh, just after particular buddies, possibly. It's hard to have everyone at desks with power cords. But if I could have had everyone at the desk, I would've preferred that.

Allan: Sorry, what I meant was, who they were with?

Sally: Oh, who they were with? Yeah, possibly the only buddy maybe twice, and [Student 1], [Student 2] and [Student 3]. [Student 3] was quite patient with [Student 2] up the front but it was taking him about five minutes to type the word Earth or longer. But he was quite patient so that was all right. He just asked if he could work with a Year 4 person next time.

[May 18, 2017]

Another strategy that Allan used to mentor Sally was to identify suitable milestones and to discuss strategies to achieve them. The submitted Review Form provided evidence for these milestones:

> Continue a steady pace + ensure students have a buddy
>
> [March 2, 2017]

> Use of technology including iPad, laptop, TV
>
> [March 9, 2017]

There was no evidence that Allan suggested strategies to Sally from the first two reflection meetings. However, Sally explained to the researcher that strategies were discussed in greater detail outside the reflection meetings [May 4, 2018]. Evidence of Allan providing strategies was found during the third reflection meeting, as shown in the following excerpt.

> Yeah, possibly. Having a look at the buddies again and just seeing who's working with who. I know I've got four or five that can do all this straightaway … it's just providing that structure for the ones that can do it all to be working on something else …
>
> [May 18, 2017]

This meeting also showed Sally contributing suggestions for future lessons. The following discussion shows how Sally and Allan discussed ways to overcome network connection difficulties by saving, prior to the lesson, the required information into a *Word* document or on a USB drive.

Sally: From building on top of this, I probably would focus on maybe searching for things on the internet. And putting those into a *Word* document. We did have a few troubles with saving into *Collaboration* due to the fact that some kids don't have *Collaboration* on their laptops.

Allan: Like a network, yeah. You could possibly have a USB. Class USB ready to save [stuff] onto it.

Sally: Yeah. I hadn't thought about that.

Allan: It could save a bit of headache.

Sally: Yeah that's a good idea actually.

[May 18, 2017]

Sally's reactions to the professional learning

The mentee's reactions present another factor that influenced the professional learning. At Ridge Primary School, evidence of Sally's commitment to professional growth came from the second reflection meeting, where Sally reported that she had reflected on her first lesson and acted upon what she had learnt.

> Seeing as this was the second lesson, I had my reflection from lesson one. That's so I can think about and use what I thought was helpful, change a few things compared to lesson one.
>
> [March 9, 2017]

Educational system and school leadership support

This factor relates to a number of different themes. Communication from the DP of the school showed that she was monitoring and supporting the professional learning progress. This was evidence that the school leadership provided structures to support the mentors and mentees to engage with the model.

> I will be meeting with them this Thursday as a check in. I have heard that the program is going well.
>
> [Email from the DP, March 6, 2017]

Initially, emails from the DP and Allan reported positive feedback about the study and its progress.

> … we started the first lesson last week. The students really enjoyed it and we are looking forward to doing the next lesson tomorrow.
>
> [Allan, March 8, 2017]

Subsequent emails relayed difficulties with organising further lesson observations.

> I am very sorry but Sally and I haven't had the chance to meet this week due to a range of factors.
>
> [Allan, March 23, 2017]

> … we didn't get release time for our lesson this week and won't get it again next week due to it being the last week etc.
>
> [Allan, March 30, 2017]

Further communications with the DP and a meeting with the participants [May 4, 2017] revealed that the DP was on leave and was no longer able to support the implementation of the professional learning model. At the same meeting, Sally and

Allan reported that the relieving DP was not able to release Allan, as scheduling casual teachers to relieve Allan had been difficult.

4.1.4 Impact of the professional learning

The results of the professional learning, as reported by the participants, are outlined in this section. Emerging from the results are two themes, mentee growth and development, and students' reactions.

Mentee growth and development

The mentee's growth and development were primarily reported using the Recording Tool as described in section 3.4.3. It proved difficult to determine Sally's growth as Figure 4.1.1 below was the only Recording Tool submitted by Ridge Primary School. It is assumed that 'L1' and 'L2' indicate two different lessons. As seen in Figure 4.1.1, 'L1' was marked in all of Stage 1, while 'L2' was marked in most of Stage 2.

Recording Tool

for the Continuum on teacher's capacity to integrate information and communication technologies (ICT) in classrooms

Appendix A

File Management and Operating System Use	*Stage 1 Substitution*		*Stage 2 Supported*		*Stage 3 Interactive*		*Stage 4 Advance*		*Stage 5 Synergy*	
	OS1a	OS1b	OS2a	OS2b	OS3a	OS3b	OS4a	OS4b	OS5a	OS5b
	✓ L1	✓ L1	✓ L2	✓ L2						

Mechanical Skills	*Stage 1 Substitution*		*Stage 2 Supported*			*Stage 3 Interactive*			
	MS1a	MS1b	MS2a	MS2b	MS2c	MS3a	MS3b	MS3c	MS3d
	✓ L1	✓ L1	✓ L2	✓ L2					
	Stage 4 Advance			*Stage 5 Synergy*					
	MS4a	MS4b	MS4c	MS5a	MS5b				

Program Variables	*St 1 Sub*	*St 2 Sup*	*St 3 Int*	*Stage 4 Advance*		*Stage 5 Synergy*	
	PV1a	PV2a	PV3a	PV4a	PV4b	PV5a	PV5b
	✓ L1	✓ L2					

Classroom Management and pedagogy	*Stage 1 Substitution*				*Stage 2 Supported*					
	CMP1a	CMP1b	CMP1c	CMP1d	CMP2a	CMP2b	CMP2c	CMP2d	CMP2e	
	✓ L1	✓ L1	✓ L1	✓ L1	✓ L2	✓ L2	✓ L2	✓ L2		
	Stage 3 Interactive				*Stage 4 Advance*			*Stage 5 Synergy*		
	CMP3a	CMP3b	CMP3c	CMP3d	CMP4a	CMP4b	CMP4c	CMP5a	CMP5b	CMP5c	CMP5d

To achieve each stage, teachers need to fulfil all of the stage's access points. Date the access point as each becomes evident.

Figure 4.1.1. Sally's achievement levels

Students' reactions

Another category of results of the professional learning is students' reactions to Sally's lessons. Students' reactions to Sally's lessons were evident in their enthusiasm for and engagement with their learning. These reactions can be found in the transcripts of the first reflection meeting, as seen in the examples below.

> So at the start, the students were really excited to use the computers which was good to see they were interested in it and throughout the lesson I would continually ask questions from the students to clarify their understanding – what was happening. (Student enthusiasm)
>
> [March 2, 2017]

> Well during the lesson, all students were sitting down quietly and they were engaged in what I was doing. (Student engagement)
>
> [March 2, 2017]

These extracts provide evidence of students' reactions to Sally's lessons that were specifically planned for technology integration.

4.1.5 Feedback on the toolkit

Participants provided feedback on the professional learning model, the framework and the supporting templates via their responses to the survey and through personal communication with the researcher, e.g. conversations and emails. The survey responses are grouped into three tables, which are:

- themes that have already been revealed in the other sections in this case study
- participant intentions after the study
- participant reflection of the process and framework.

Qualitative responses from the surveys are placed next to the relevant sections in the tables.

At Ridge Primary School, the survey responses are shown in Tables 4.1.1, 4.1.2 and 4.1.3. Table 4.1.4 presents feedback about the framework and the process from personal communications, which included both critical and supportive comments.

Table 4.1.1

Case 1: Survey responses relating to previous themes

Theme	Question	Allan	Sally	Qualitative
Support	My mentor: [Q3.1]			
	was supportive.	N/A	Agree	*Nil*
	was available for support.	N/A	Agree	*Nil*
Mentor expertise	My mentor: [Q3.1]			
	is well-versed in integrating ICT in classrooms.	N/A	Agree	*Nil*
	adequately identified my level of understanding for integrating ICT.	N/A	Agree	*Nil*
	facilitated my learning progression.	N/A	Agree	*Nil*
	The process/framework: [Q3.3]			
	has helped me improve my integration of ICT.	Disagree	N/A	*Nil*
	has added to my knowledge of the potential of ICT in education.	Disagree	N/A	*Nil*
	was beneficial to me as the mentor.	Agree	N/A	*Nil*

Theme	Question	Allan	Sally	Qualitative
Educational system and school leadership support	The process/framework:			
	was manageable in terms of time. [Q3.3d]	Agree	Disagree	*Nil*
	Were you afforded more time to observe and meet with your mentee? [Q3.5]	Yes	N/A	It was necessary to have more time, it would of [sic] been too hard to complete the project without it! [Allan]
Mentee growth and development	My mentee was: [Q3.1]			
	eager to shift and demonstrate growth according to the framework/process.	Agree	N/A	*Nil*
	receptive to my suggestions.	Strongly agree	N/A	*Nil*
	an active participant in the partnership.	Strongly agree	N/A	*Nil*
	The process/framework: [Q3.3]			
	has helped me improve my integration of ICT.	N/A	Disagree	*Nil*
	has helped change my teaching pedagogies.	N/A	Disagree	*Nil*
	has added to my knowledge of the potential of ICT in education.	N/A	Agree	*Nil*

Theme	Question	Allan	Sally	Qualitative
Students' reactions	After the study: [Q3.5]			
	my students are more engaged due to my ability of ICT integration.	N/A	Agree	*Nil*
	my students are attaining more learning outcomes due to my lessons being more enriched by ICT.	N/A	Disagree	*Nil*

Table 4.1.2

Case 1: Participant intentions after the study

Question	Allan	Sally
After the study: [Q3.7 (mentor) and Q3.5 (mentee)]		
I will continue to work with my mentee/mentor to improve their level of ICT integration.	Agree	Agree
I will continue to use the framework.	Agree	Disagree
I am happy to mentor other colleagues. (Mentor)	Agree	N/A
I feel confident in mentoring other teachers in integrating at least some aspects of ICT. (Mentee)	N/A	Agree

Table 4.1.3

Case 1: Participant feedback regarding the process and framework

Question	Allan	Sally
My mentee and their skills were easily identified on the framework. [Q3.1b]	Agree	N/A
The process and framework: [Q3.3]		
gave me the tools to provide practical advice to my mentee.	Agree	N/A
made it easier to mentor, given the explicit instructions and instruments.	Agree	N/A
has useful instruments important to the process.	Agree	Agree
is cost effective.	Strongly agree	Agree
has been a greater benefit than a one-off course.	N/A	Agree
was easy to follow.	Agree	Agree

Table 4.1.4

Case 1: Consolidated feedback relating to the framework and the process

Framework	▪ The language needs to be simpler. ▪ The aesthetics should reflect something similar to "outcomes/indicators" look, as seen in the older NSW syllabuses. ▪ The title needs to be more attractive. ▪ Provides a good scaffold for ICT integration skills.
Process	▪ The templates surrounding the framework need more guidance.

4.1.6 Summary of Ridge Primary School's case study

Ridge Primary School was the first school to implement the professional learning model of this study. During the study, Allan and Sally, the mentor and the mentee respectively, progressively developed a mentor-mentee relationship, which led to more interactive and collaborative reflections towards the end of the study period. Both Allan and Sally showed some skills against the TPACK Framework, with

Sally having more opportunities to demonstrate her TPK than Allan. The limitations that Sally encountered in this case study were concerned primarily with connectivity and reliability of her and her students' technologies, and problems regarding releasing Allan to observe her lessons. The issues of teacher release resulted in this case study ending after three cycles. Despite these constraints, Sally showed some growth after the cycles and reported that students in her class showed enthusiasm for and engagement with lessons that were explicitly integrated with technology. These will be examined in more detail in Chapter 5.

Case 2: Hunter Primary School

Hunter Primary School, the second case in this study, is a medium-sized school. As described in section 3.3.3, the mentor in this school was Rob, an experienced teacher teaching Years 5 and 6, and the mentee was Angela, a newly qualified teacher teaching Kindergarten. The participants had an existing supervisory relationship, which will be discussed in more detail in section 4.2.1. The participants were able to complete all six cycles, as well as one additional lesson observation between the first and second cycles. During the case study, Angela integrated interactive technologies into the English and Mathematics key learning areas. Evidence from this case is presented in categories similar to those for Ridge Primary School, with additional categories, factors and themes noted where appropriate.

4.2.1 Mentor-mentee relationship

At the beginning of the study, the mentor-mentee relationship at Hunter Primary School appeared to be already well established. Previously, Rob served as the supervising teacher for Angela during one of Angela's school-based practical experiences. Evidence of an existing relationship can be found during the first reflection meeting, when the participants were comparing Angela's actions with the access points in the framework. Rob referred to Angela's abilities, which he had observed in the previous year, when explaining to Angela where her abilities may fit in the framework.

> Because placing onto this continuum [framework], you're already in Stage 2, Stage 3. Around there, you know? You do that automatically and I saw a lot of that last year. But Stage 2, Stage 3, you're dabbling here. We're trying to get you up to here – to Advance and Synergy.
>
> [March 17, 2017]

This existing relationship, as seen in all recording transcripts, was further evidenced in two ways. The first was in the participants' statements during the mid-study visit [May 12, 2017]. Rob stated that he considered Angela a friend, while Angela explained that they helped each other out. A second example of their rapport is illustrated in the excerpts below, in the relaxed comments made by Rob and Angela to each other throughout the reflection meetings. While discussing possibilities for Angela to access expert knowledge, she responded:

> I mean, you could always come in [laughter]. You're an expert, aren't you?
>
> [April 3, 2017]

As a joke of how he started every reflection meeting, Rob stated at one of the later reflection meetings:

> I'll start with my usual, "Okay [laughter]." All right.
>
> [May 12, 2017]

The existing relationship and the rapport between Angela and Rob served as a basis for their mentor-mentee relationship in their mentoring process. This mentor-mentee relationship manifested itself in a variety of ways. Firstly, Rob encouraged and advised Angela, as seen in the following example.

> No. All right. So last night you emailed the digital lesson plan, which is really good. I think that's starting to take off some of 'Sharing resources between colleagues'.
>
> [April 3, 2017]

Rob was willing to support Angela throughout the process, revealing another aspect of the mentor-mentee relationship. The example below shows Rob offering to support Angela out of class to develop her skills in using technology when lesson planning and doing administration tasks.

> Rob: Maybe if I don't come in and observe the actual teaching, but we look at *File Management* side of things …
>
> Angela: Yeah, I'm a bit lost there.
>
> Rob: … and the prep time for the lesson.
>
> Angela: That'd be really helpful to me, yeah. And also, I'd love to learn more about … I can remember [Teacher] making lesson plans on the *Smartboard*. They weren't very sophisticated. There's a little bit of music and moving, but I think I could really …
>
> Rob: Through *Notebook*?
>
> Angela: It was just a … it was *Smart Note* or *Smart* … no, it just was a *Smartboard* app.
>
> Rob: Yeah. Yeah, it's *Smart Note*. Yep. Let's work on that then.
>
> [April 3, 2017]

Rob further supported Angela's development by ensuring that she understood how to use some of his suggested strategies. The two extracts below show Rob explaining a concept to Angela, and then an example that Rob used from his class to illustrate the potential of a strategy.

> Just so you get into that flipping between and getting kids used to that way of thinking because when you get into that higher order stuff of design - you do need to go and research with the web browser opened and then create on that screen … Get your inspiration from one source, close window. All of that needs to be native and natural.
>
> [March 17, 2017]

> Well, I present my kids' work on that newsfeed where they can comment. And I've asked the parents to keep it positive, celebrate, which they do anyway, but I've felt like I've had to do it.
>
> [April 4, 2017]

Another element of Rob's support was the provision of regular feedback to Angela in order to reinforce certain behaviours. An example of this feedback can be seen below, where Rob discussed his observation of integrated technology use as part of a mathematics groups' rotation. Rob stated:

> And that's real true integration and learning. So I was really impressed with that. And the kids were all self – that wasn't THE special group with the iPads. The board wasn't the special group. Because it was so natural, even the paper tasks, they all had the same weight in the room.
>
> [March 28, 2017]

4.2.2 Factors influencing Angela's integration of technology

The factors in this category at Hunter Primary School were similar to those at Ridge Primary School. New factors introduced at Hunter Primary School are those of Angela's attitudes, which is grouped with her skills in this section, and her students' skills and attitudes.

Angela's skills and attitudes

Angela's skills when integrating interactive technologies can be seen in the excerpts below, where there is evidence of her TK, PK, TPK and TPACK.

> I don't know if my computer's really up-to-date or there's something wrong with – I tried to download it. I think it was probably more me than anything else. But it sort of got to a certain point and started downloading,

and then it said it was unable to go any further – that I had to be the administrator. But I thought that that's what I was doing. So it's my knowledge that's stopping me, I think. (Limited by knowledge, TK)

[Angela, May 12, 2017]

Yeah for sure. They'll enjoy it more. They'll be engaged. My top learners will learn much better. It'll be good. (Differentiating learning, PK)

[Angela, March 17, 2017]

Website failed … you had a backup, not that it was planned. You knew where to access the same content in a different source, which was really, really good. (Knowledge of technologies to deliver content, TK)

[Rob, March 24, 2017]

When you're up at the back of the room and there was a problem with that group. The board experienced the problem and I really liked what you did next. You calmly walked back down to them, down to the *Smartboard*. And one of the girls said, "Ms Angela, he pressed … " and you just calmly responded, "What can you do to fix it?", instead of going, "You just do this … ". You used it as a teaching moment, and you sat with them and explained your thought process and modelled how to problem solve this … And it didn't work on the board, so you took them over to the computer and you did exactly the same thing. (Using technology issues as teaching moments, TPK)

[Rob, March 24, 2017]

I would like to bring some parents in at guided reading time just to get children – well, and actually maths time just to get some help. That would be community. Because on the iPads you can use these pages and they can type and take a photograph … But I would need extra parent help for that because that may be focused intensive work, too. I could get my top group to do that just to sort of start them to type and understanding that a keyboard– (Using members of the wider school community to assist with students' learning when using technology, TPACK)

[Angela, April 3, 2017]

Angela's skills were also recorded in Rob's field notes. These show Angela's skills in the TPK and PK components.

Used no verbals, relied upon *Smartboard* to award or remind about student behaviour. (Using technology for classroom management, TPK)

[April 3, 2017]

Monitoring group work. Allowed students to use during scaffolded modelling. (Scaffolding learning, PK)

[May 12, 2017]

Angela's developing confidence emerged as a factor at this school. This was a factor that contributed to Angela's ability to demonstrate her skills. The two excerpts below are from the first and fifth reflection meetings, where Angela began to take risks when using different devices to consolidate digital learning activities in order to facilitate learning and lesson flow.

So I could have … even possibly risk an iPad, rather than having my phone there.

[Angela, March 17, 2017]

Well, I was looking for money. I wanted to create – with the spelling words – I wanted to actually create something that I can drop and drag myself – and I haven't done that yet – by putting them into little boxes and

> including *YouTube* clips and stuff like that. Making my own lessons, rather than just bits and pieces. Sort of adding it as one big lesson. And it's all there. I don't have to flip around.
>
> [Angela, May 12, 2017]

Angela's confidence affected her choice and use of technology during lesson observations, which is highlighted by the statement below.

> She felt very nervous challenging herself with the Tech in front of me, she felt supported, but it was a confidence thing, and feels she was able to use the feedback and tech better when the room was hers. She was very selective when she knew I was coming. Sometimes felt like she was using tech for I.T. sake. Feels like she still has a very long way to go.
>
> [Email from Rob, July 19, 2017]

Access to technology

Access to technology emerged as a factor affecting Angela's ability to integrate technology. At this school, access is defined as the availability of the technology. This was only evident during the first two cycles, with no further evidence found in the subsequent reflection meetings. The excerpt below is an example that illustrates this issue.

> I thought it would be great, once we do have our iPads, I could actually have them, if we book the whole bank of iPads.
>
> [March 17, 2017]

Students' skills and attitudes

This factor was not apparent at Ridge Primary School. It refers to how students' skills and attitudes can impact on the mentee's ability to integrate technology. At Hunter Primary School, it was revealed by the numerous references made by Rob and Angela to their concerns regarding Kindergarten students' ability and level of development. Below is a typical example.

> You may have reached the upper levels of what we can do with Kinder in the first part of the year.
>
> [Review Form, March 28, 2017]

Similarly, Rob considered that students' attitudes toward technology affected its use for learning purposes.

> The devices, especially at this age … I mean I opened my iPad and [Student] came to me and said, "Are you playing a game?". We need to get them away [from] looking at these as this is the games device, the entertainment console, whatever, to a learning device.
>
> [March 17, 2017]

While there were obvious concerns relating to students' skills and attitudes when using technology for learning, Angela and Rob considered the way that students' natural abilities, willingness to explore and readiness to support their peers facilitated Angela's integration of technologies. Indicators for these themes can be seen in the following examples.

> They knew exactly what they were doing. They're out of *Mathletics*, into *Dojo* [*ClassDojo*], looking at their points because they knew we had awards coming today. That blew me away, that they could just so naturally do that. Yeah. So they're clever. (Students' natural abilities with technology)
>
> [Angela, March 28, 2017]

Rob: And did you notice they were changing between pens and pencils and the actual rubber bands?

Angela: Well, I did, because I've got stuff I didn't know where I couldn't drag the rubber bands until they figured out their pens were there, so. Yeah, they've done it, so that was trial and error …
(Willingness to self-explore)

[April 3, 2017]

They don't see it as failing, because if they need help, I just say, “Do you need someone from the crowd?”, and they're quite happy to get someone to come up and help them. (Peer tutoring)

[Angela, May 12, 2017]

These student behaviours provide evidence of their reactions to both Angela’s teaching and their learning when Angela purposefully integrated technologies.

4.2.3 Factors contributing to the professional learning

As at Ridge Primary School, the themes in this category from Hunter Primary School were mentor capacity, mentee’s interaction with the learning, and educational system and school leadership support. The factor of the mentor’s motivation to conduct the professional learning emerged from this school, which has been grouped with the category of mentor capacity.

Mentor capacity and motivation

Rob’s capacity as a mentor was firstly revealed in his expertise when integrating interactive technologies. The data showed this in the PK, TK and TPK components.

> But if you do that, it's starting to teach them how to modulate their own behaviour. It's reinforcing those good choices that they're making. You know, all of those can of worms open up too. (Discussing classroom management, PK)
>
> [Rob, March 17, 2017]

> We've got to try to see some metalanguage of the ICT, so you know, this is 'click and drag', and you know … (Use of metalanguage, TK)
>
> [Rob, March 17, 2017]

> We're still trying to go from, "Here's a book and yes, you can use an iPad as a book if you choose so [to]." I would argue if you've got the book, use the book, not the iPads. You know, you don't want to make it superficial. You want it to be relevant. You want the best tool to do the job too. (Appropriate selection of learning tool, TPK)
>
> [Rob, March 17, 2017]

Rob used a number of different mentoring strategies to facilitate Angela's growth, demonstrating his capacity as a mentor. For example, Rob used questioning strategies to elicit responses from Angela to develop her TK.

> Rob: How can you fix that without having someone come and visit, and sit over your shoulder?
>
> Angela: Oh, I think I could search on the internet. And I guess I could search why is that happening.
>
> Rob: So what I usually do is *YouTube* things, or type the problem into *Google*. I would say that the *Smart Notebook* website would have a lot of help packages, or step-throughs or run-throughs to load your programs on.

Angela: OK. All right. I'll try that because I'd like to do things at home so they're ready and I don't have to sit in here all the time.

Rob: And the more that you can self-help, the more your skills come on.

Angela: Yep. That's true. Yeah. OK. I will do that. Very good.

[May 12, 2017]

Two other mentoring strategies Rob employed were identifying milestones and providing strategies to Angela. Factors also emerging at Hunter Primary School were Rob reviewing previous milestones and negotiating milestones with Angela. These behaviours can be seen in the following examples.

Rob: Good! That will actually work on the green tasks [in the framework], which would be great.

Angela: Do you want to put in behaviour management stuff?

Rob: Yeah, so from here, to encourage them to self-regulate …
(Identifying appropriate milestones)

[March 17, 2017]

Angela: I'd like to … just create my own sight words. Maybe, bingo games or … because I've seen other ones they have in the place.

Rob: Even with maths, you can roll the dice and get them to do all that counting activities and …

Angela: Rather than relying on websites, yeah. That'd be good if I could do that.
(Negotiating milestones)

[April 4, 2017]

> So if we look at our post-observation review [Review Forms], we'll just jump back to last one from Friday. Yes, I've said you've addressed milestones one and three. The correct terms for the ICT you're using. Yes, very much so because of today's session. (Reviewing milestones)
>
> [Rob, March 24, 2017]

Rob:	Have you sat down with *Dojo* and actually come up with the behaviours, with the skills you want them to have?
Angela:	Some. I think they need to be updated.
Rob:	Have they had input with it?
Angela:	No, I haven’t and that’s something I haven’t done.
Rob:	Bring them into it. If they have ownership on the skills, those points become so much more valuable.
Angela:	And I don't think they actually know … they know that 'bom-bom' means they've done something wrong and they know what they've done wrong but I don't think they know each picture that well yet.
Rob:	You can use that as a little session. I mean, if you even have a good speller, put them on the keyboard and they can spell it out. (Providing strategies)

[March 17, 2017]

Rob’s use of the framework to identify milestones for Angela was evident in his exchanges with her. This can be seen in the example below where Rob was describing the access points and stages of the framework while discussing Angela’s progress.

> … *Mechanical Skills* we will have to focus on because, as you can see, visually it's not up to the same standards that you do naturally. That's OK, we'll get there. And that's just different devices. I really feel once we get some iPads going … And then really, you will be up to, you know, [a] similar stage to how I teach and some of the leaders in the school have [sic] they use technology. Because I don't think anyone here is up to Synergy, if they're honest.
>
> [Rob, March 24, 2017]

In a similar way to the case at Ridge Primary School, Rob used the Review Form to record milestones and strategies. An extract illustrating this use is seen below.

> Milestone: Use technology to link student learning to authentic task
>
> Strategy: Make video of road safety
>
> [March 28, 2017]

An examination of the transcripts of the reflection meetings and Rob's field notes provided evidence that Rob used the field notes to facilitate the meetings' discussions. This can be seen in the examples below.

> Where did the worksheets come from? Could you make them? What websites have that content?
>
> [Field notes, March 20, 2017]

> Rob: You had your emergent counting worksheet – and you demo'ed that. Even though that's a paper thing, like a worksheet. You used the *Dojo* to reward the whole time. And you're rewarding the good listening. I wondered did you use a

photocopy from the book or [are] you downloading from *Burrabooks.com*?

Angela: I haven't used either of those ones.

Rob: I noticed the worksheets were from *Burrabooks* so if you're downloading that, it's also something else we can record.

Angela: I think I got that from [Teacher] who may have downloaded before.

Rob: Yeah so if you can go out and do that too – download, like with the *Mathletics* worksheets and things like that.

[March 24, 2017]

During the mid-study visit (March 28, 2017), Rob revealed, in a conversation with the researcher, a variety of reasons for his participation in the professional learning process. In particular, he noted a need for a culture change in the school. He stated that the use of ICT was considered 'an extra' to teaching and learning. Rob explained that there was little discussion or professional learning around the effective use of technology in teaching and learning. He has attempted to remedy this by engaging his colleagues in discussions after work and at social events.

Angela's reactions to the learning

Different themes within this factor emerged at Hunter Primary School. Angela's interaction with the professional learning process, through being receptive to the mentor's advice and seeking further guidance about the concepts discussed, can be seen in the examples below.

I will take your advice on this one. (Receptiveness to mentor's advice)

[Angela, March 24, 2017]

> Thinking, you know, I can talk to them about that. How often do we reset [in *ClassDojo*]? (Seeking guidance)
>
> [Angela, March 17, 2017]

Educational system and school leadership support

This factor at Hunter Primary School affected both Rob's ability to mentor Angela and Angela's ability to develop her technology integration skills. During a conversation with the researcher [May 12, 2017], Rob explained that he was relieving as one of the assistant principals at his school, affording him additional release from face-to-face (RFF) time. He was using this additional time to observe Angela's lessons. Rob emphasised that it would have been impossible to observe Angela if he was not afforded this additional time.

During the same conversation, Rob noted there was some resistance from some of the teachers in the school towards integrating ICT. An email from Rob revealed that Angela felt this resistance.

> [Angela] feels restricted to the school's way of teaching Kindergarten. Activities are created and strongly recommended to follow by highly experienced teachers that are not confident users of I.T. themselves. So, Angela feels like she can't fully explore all that she could.
>
> [July 19, 2017]

4.2.4 Impact of the professional learning

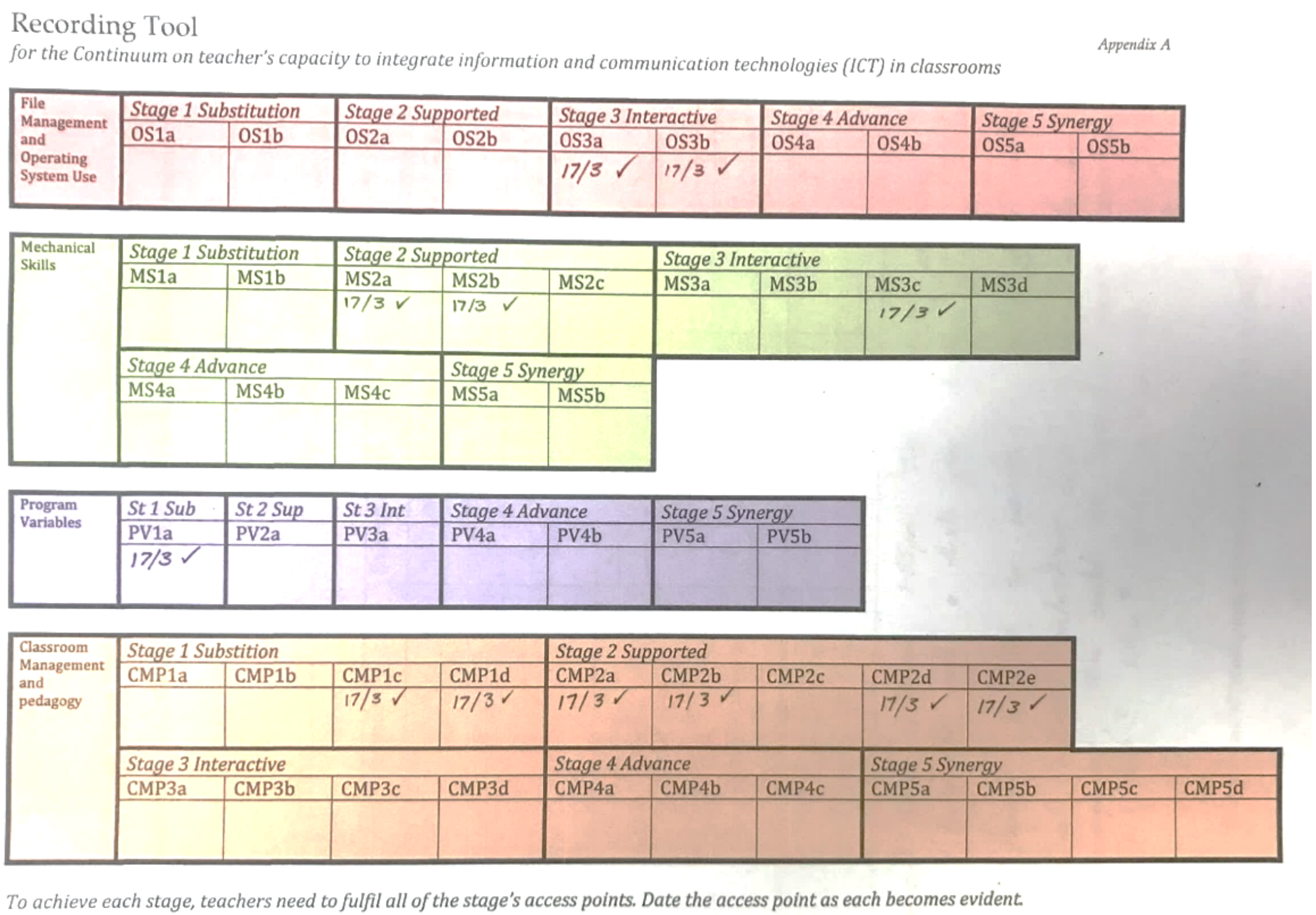
As in the previous case, this section outlines the evidence relating to the impact of the professional learning and is organised into two broad themes of Angela's growth and development, and students' reactions.

Mentee growth and development

The data relating to Angela's growth and development came from statements made during the reflection meetings and from the completed instruments. The data from the reflection meeting presents evidence of Angela's growth:

> This time, as well as doing your visual demo, you were quite verbal. So you were verbalising your thought process as you were pointing, you were using all the metalanguage, it was just … it was at a different level, you know. And it was just a slight couple of tweaks from last Monday's.
>
> [Rob, March 24, 2017]

Rob recorded Angela's achievement against the framework after every lesson observation. Figure 4.2.1 shows Angela's beginning level. As seen in this figure, the highest stage Angela had achieved was Stage 3, in *File Management and Operating System Use*. She was only beginning to achieve Stage 3 for *Mechanical Skills*. Figure 4.2.2 was captured at the second reflection meeting [March 24, 2017] and shows that some of the gaps seen in Figure 4.2.1, such as in *Classroom Management and Pedagogy*, no longer exist. Other competencies that were achieved after the first reflection meeting can be seen in the domains *Program Variables* and *File Management and Operating System Use*. Figure 4.2.3 presents Angela's achievement at the end of the study. This figure shows that most of the access points have been marked, with the exception of only a few found in *Program Variables* and *Classroom Management and Pedagogy*.



Recording Tool

for the Continuum on teacher's capacity to integrate information and communication technologies (ICT) in classrooms

Appendix A

File Management and Operating System Use	Stage 1 Substitution		Stage 2 Supported		Stage 3 Interactive		Stage 4 Advance		Stage 5 Synergy	
	OS1a	OS1b	OS2a	OS2b	OS3a	OS3b	OS4a	OS4b	OS5a	OS5b
					17/3 ✓	17/3 ✓				

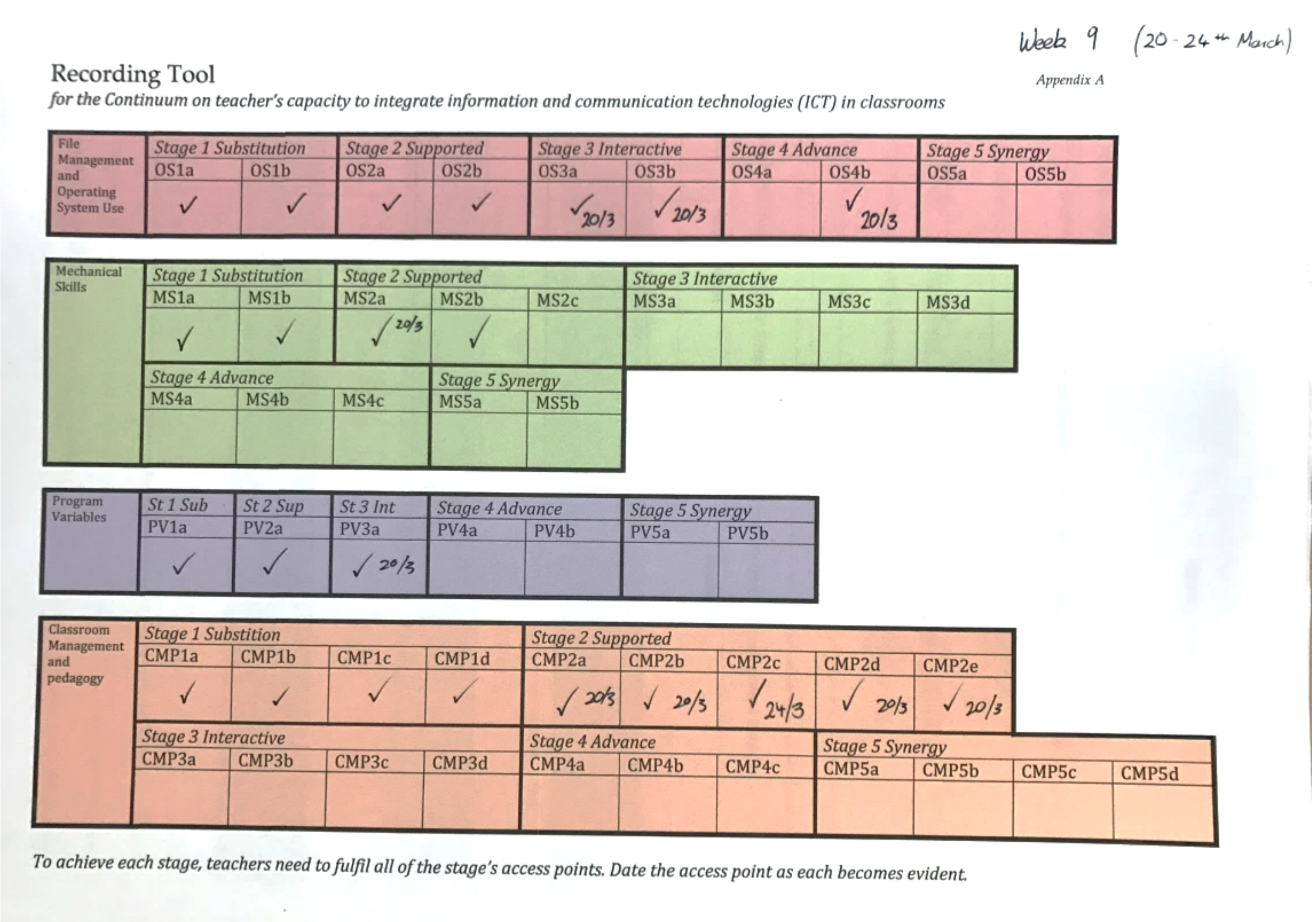
Mechanical Skills	Stage 1 Substitution		Stage 2 Supported			Stage 3 Interactive			
	MS1a	MS1b	MS2a	MS2b	MS2c	MS3a	MS3b	MS3c	MS3d
			17/3 ✓	17/3 ✓				17/3 ✓	
	Stage 4 Advance			Stage 5 Synergy					
	MS4a	MS4b	MS4c	MS5a	MS5b				

Program Variables	St 1 Sub	St 2 Sup	St 3 Int	Stage 4 Advance		Stage 5 Synergy	
	PV1a	PV2a	PV3a	PV4a	PV4b	PV5a	PV5b
	17/3 ✓						

Classroom Management and pedagogy	Stage 1 Substitution				Stage 2 Supported					
	CMP1a	CMP1b	CMP1c	CMP1d	CMP2a	CMP2b	CMP2c	CMP2d	CMP2e	
			17/3 ✓	17/3 ✓	17/3 ✓	17/3 ✓		17/3 ✓	17/3 ✓	
	Stage 3 Interactive				Stage 4 Advance			Stage 5 Synergy		
	CMP3a	CMP3b	CMP3c	CMP3d	CMP4a	CMP4b	CMP4c	CMP5a	CMP5b	CMP5c	CMP5d

To achieve each stage, teachers need to fulfil all of the stage's access points. Date the access point as each becomes evident.

Figure 4.2.1. Angela's beginning level



Week 9 (20-24th March)

Appendix A

Recording Tool

for the Continuum on teacher's capacity to integrate information and communication technologies (ICT) in classrooms

File Management and Operating System Use	*Stage 1 Substitution*		*Stage 2 Supported*		*Stage 3 Interactive*		*Stage 4 Advance*		*Stage 5 Synergy*	
	OS1a	OS1b	OS2a	OS2b	OS3a	OS3b	OS4a	OS4b	OS5a	OS5b
	✓	✓	✓	✓	✓ 20/3	✓ 20/3		✓ 20/3		

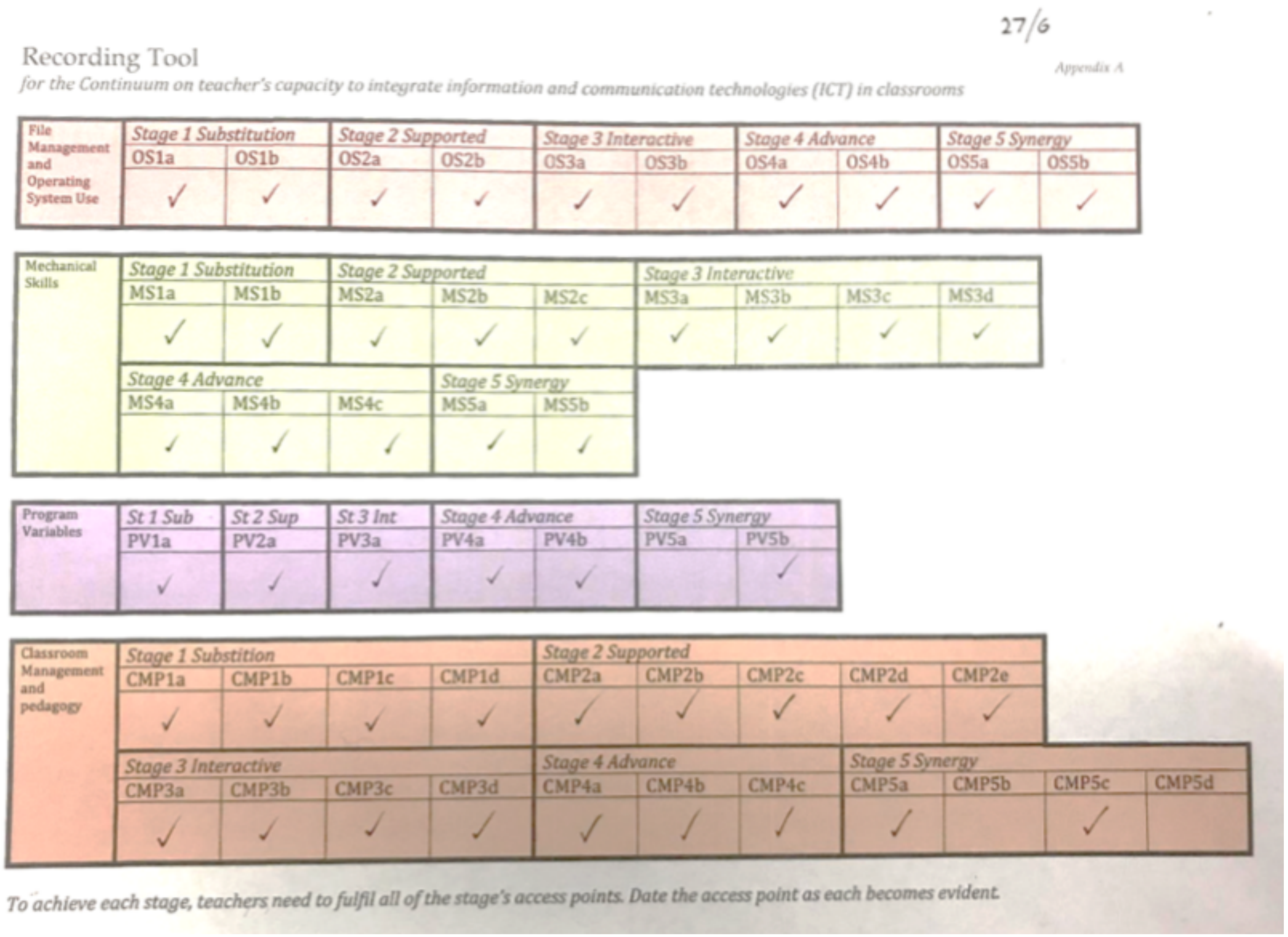
Mechanical Skills	*Stage 1 Substitution*		*Stage 2 Supported*			*Stage 3 Interactive*			
	MS1a	MS1b	MS2a	MS2b	MS2c	MS3a	MS3b	MS3c	MS3d
	✓	✓	✓ 20/3	✓					
	Stage 4 Advance			*Stage 5 Synergy*					
	MS4a	MS4b	MS4c	MS5a	MS5b				

Program Variables	*St 1 Sub*	*St 2 Sup*	*St 3 Int*	*Stage 4 Advance*		*Stage 5 Synergy*	
	PV1a	PV2a	PV3a	PV4a	PV4b	PV5a	PV5b
	✓	✓	✓ 20/3				

Classroom Management and pedagogy	*Stage 1 Substitution*				*Stage 2 Supported*				
	CMP1a	CMP1b	CMP1c	CMP1d	CMP2a	CMP2b	CMP2c	CMP2d	CMP2e
	✓	✓	✓	✓	✓ 20/3	✓ 20/3	✓ 24/3	✓ 20/3	✓ 20/3
	Stage 3 Interactive				*Stage 4 Advance*			*Stage 5 Synergy*				
	CMP3a	CMP3b	CMP3c	CMP3d	CMP4a	CMP4b	CMP4c	CMP5a	CMP5b	CMP5c	CMP5d

To achieve each stage, teachers need to fulfil all of the stage's access points. Date the access point as each becomes evident.

Figure 4.2.2. Angela's mid-study



27/6

Recording Tool

Appendix A

for the Continuum on teacher's capacity to integrate information and communication technologies (ICT) in classrooms

File Management and Operating System Use	Stage 1 Substitution		Stage 2 Supported		Stage 3 Interactive		Stage 4 Advance		Stage 5 Synergy	
	OS1a	OS1b	OS2a	OS2b	OS3a	OS3b	OS4a	OS4b	OS5a	OS5b
	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

Mechanical Skills	Stage 1 Substitution		Stage 2 Supported			Stage 3 Interactive			
	MS1a	MS1b	MS2a	MS2b	MS2c	MS3a	MS3b	MS3c	MS3d
	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Stage 4 Advance			Stage 5 Synergy					
	MS4a	MS4b	MS4c	MS5a	MS5b				
	✓	✓	✓	✓	✓				

Program Variables	St 1 Sub	St 2 Sup	St 3 Int	Stage 4 Advance		Stage 5 Synergy	
	PV1a	PV2a	PV3a	PV4a	PV4b	PV5a	PV5b
	✓	✓	✓	✓	✓		✓

Classroom Management and pedagogy	Stage 1 Substitution				Stage 2 Supported				
	CMP1a	CMP1b	CMP1c	CMP1d	CMP2a	CMP2b	CMP2c	CMP2d	CMP2e
	✓	✓	✓	✓	✓	✓	✓	✓	✓

Classroom Management and pedagogy	Stage 3 Interactive				Stage 4 Advance			Stage 5 Synergy			
	CMP3a	CMP3b	CMP3c	CMP3d	CMP4a	CMP4b	CMP4c	CMP5a	CMP5b	CMP5c	CMP5d
	✓	✓	✓	✓	✓	✓	✓	✓		✓	

To achieve each stage, teachers need to fulfil all of the stage's access points. Date the access point as each becomes evident.

Figure 4.2.3. Angela's end level

Students' reactions

This section provides examples of students' responses to Angela's lessons. The first example shows students' disinterest when writing sight words on plates, rather than on the IWB.

> And they were getting bored and they would be bored sitting there. They didn't want to do plates at all.
>
> [Angela, March 17, 2017]

The next excerpt typifies the numerous examples of student engagement and enthusiasm when Angela successfully integrated technology.

> So, some of the kids who wouldn't necessarily put their hand up to come and read something out of the big book will come up and happily read and circle things from the board, and they know more than they think they do. Yeah, so it's been good.
>
> [Angela, May 12, 2017]

4.2.5 Feedback on the toolkit

The feedback on the toolkit, including the professional learning model, framework and supporting templates is presented in Tables 4.2.1, 4.2.2, 4.2.3 and 4.2.4, grouped in the same way as Ridge Primary School.

Table 4.2.1

Case 2: Survey responses relating to previous themes

Theme	Question	Rob	Angela	Qualitative
Support	My mentor: [Q3.1]			
	was supportive.	N/A	Strongly agree	*Nil*
	was available for support.	N/A	Strongly agree	*Nil*

Theme	Question	Rob	Angela	Qualitative
Mentor expertise	My mentor: [Q3.1]			
	is well-versed in integrating ICT in classrooms.	N/A	Agree	*Nil*
	adequately identified my level of understanding for integrating ICT.	N/A	Agree	*Nil*
	facilitated my learning progression.	N/A	Agree	*Nil*
	The process/framework: [Q3.3]			
	has helped me improve my integration of ICT.	Agree	N/A	*Nil*
	has added to my knowledge of the potential of ICT in education.	Agree	N/A	*Nil*
	was beneficial to me as the mentor.	Agree	N/A	*Nil*
Educational system and school leadership support	The process/framework:			
	was manageable in terms of time. [Q3.3d]	Agree	Agree	*Nil*
	Were you afforded more time to observe and meet with your mentee? [Q3.5]	No	N/A	More time would have been most beneficial. It was extremely difficult to experience a well-rounded program when you are "stealing time". [Rob]
Mentee growth and development	My mentee was: [Q3.1]			
	eager to shift and demonstrate growth according to the framework/process.	Strongly agree	N/A	*Nil*

Theme	Question	Rob	Angela	Qualitative
	receptive to my suggestions.	Strongly agree	N/A	*Nil*
	an active participant in the partnership.	Strongly agree	N/A	*Nil*
	The process/framework: [Q3.3]			
	has helped me improve my integration of ICT.	N/A	Agree	*Nil*
	has helped change my teaching pedagogies.	N/A	Agree	*Nil*
	has added to my knowledge of the potential of ICT in education.	N/A	Agree	*Nil*
Student reactions	After the study: [Q3.5]			
	my students are more engaged due to my ability of ICT integration.	N/A	Agree	*Nil*
	my students are attaining more learning outcomes due to my lessons being more enriched by ICT.	N/A	Agree	*Nil*

Table 4.2.2

Case 2: Participant intentions after the study

Question	Rob	Angela
After the study: [Q3.7 (mentor) and Q3.5 (mentee)]		
I will continue to work with my mentee/mentor to improve their level of ICT integration.	Agree	Agree
I will continue to use the framework.	Agree	Disagree
I am happy to mentor other colleagues. (Mentor)	Agree	N/A

I feel confident in mentoring other teachers in integrating at least some aspects of ICT. (Mentee)	N/A	Agree
Other comments: This study has been particularly beneficial as without having a progress plan I may not have integrated ICT as effectively in the classroom. I do now feel confident to teach others about how ICT can be used with students. Although, there are still teachers working currently who have no interest in ICT and believe it has no place in the infants classes. [Angela]		

'Infants classes' is a term commonly used in NSW for classes in Kindergarten to Year 2.

Table 4.2.3

Case 2: Participant feedback regarding the process and framework

Question	Rob	Angela
My mentee and their skills were easily identified on the framework. [Q3.1b]	Agree	N/A
The process and framework: [Q3.3]		
gave me the tools to provide practical advice to my mentee.	Agree	N/A
made it easier to mentor, given the explicit instructions and instruments.	Agree	N/A
has useful instruments important to the process.	Agree	Agree
is cost effective.	Agree	Disagree
has been a greater benefit than a one-off course.	N/A	Agree
was easy to follow.	Agree	Agree
Other comments: Thank you for giving our school the opportunity to take part in your study. We have found it to be very enjoyable and useful. All the best, Angela. [Angela]		

Table 4.2.4

Case 2: Consolidated feedback relating to the framework and the process

Framework	▪ Is well-regarded by Rob and another member of the school's IT committee. Rob's regard for the framework was also evidenced by his use of the framework with other new scheme teachers ▪ Is detailed and used explicit language ▪ Includes many things for the mentee to work towards ▪ Is easy to follow and showed clear progression ▪ Highlights where 'gaps' in mentee skills and knowledge were and where those 'gaps' came from ▪ Aligns well with the syllabus and teacher accreditation requirements ▪ Use of the word 'stage' was confusing. Teachers may confuse this with the scholastic stages as described in the NSW syllabuses
Process	▪ Future-proofs professional learning at the school, due to the process engaging the mentor and mentee in collaborative learning ▪ Is useful, along with the framework, to upskill teachers

'New scheme teachers' is a commonly used term in NSW schools referring to teachers who graduated from university after 2004 and were required to be accredited at 'Proficient' level of teacher accreditation. Since 2018, all teachers in NSW are required to be accredited at 'Proficient' (DoE, 2018a; NESA, 2018b; Teacher Accreditation Act 2004 (NSW)).

Further feedback on the framework was given by Rob when he explained why he marked Angela's progress non-sequentially, contrary to the intention explained in section 3.4.3. His explanation can be found in both a transcript of a reflection meeting [March 24, 2017] and in an email he sent. He stated:

> During our observation and feedback sessions, we found it natural to plot Angela onto the continuum [framework] where she entered the study. I know the intention is for there to be a sequence, however, the previous steps would be in basic operations or functions that Angela is already proficient in and does naturally. We made the decision to extend or work towards rather than revise her capacity to implement teaching and learning cycles using ICTs.
>
> [Email from Rob, March 28, 2017]

4.2.6 Summary of Hunter Primary School's case study

Hunter Primary School, as the second case study, revealed an already established supervisory relationship between Rob, the mentor, and Angela, the mentee. During the professional learning, Rob chose relevant mentoring strategies to assist Angela's development as a teacher, as well as developing her skills in integrating technologies. Throughout the case study, both Rob and Angela demonstrated skills against the TPACK Framework, particularly in the TPK component.

Various limitations on Angela's ability to integrate technologies were evident, including the availability of the technologies and of collegial support. Despite these, Angela demonstrated growth when displaying pedagogies of technology integration during the case study, which Rob monitored by recording her progress on the Recording Tool after every lesson observation. The contributing factors to Angela's growth and her ability to integrate technologies will be considered in the next chapter.

Case 3: River Primary School

The following sections present evidence from River Primary School, within similar categories to those identified in the previous cases. As with Case 2, additional categories and themes are noted where they appear. River Primary School, as described in section 3.3.3, had two mentors. When the first mentor, Andrew, moved to another school, the second mentor, David, took over the mentoring. David did not engage with a pre-study meeting, as described in section 3.3.3, and showed some confusion about the process during the mid-study visit. Many of the questions he asked during this visit were to clarify how to implement the process and how to use the instruments in this study. Both mentors taught the same Year 5 class, while Kelly, the mentee, taught another Year 5 class. To allow for the lesson observations, the two Year 5 classes were combined for lessons targeting outcomes from the History and Geography key learning areas. To accommodate for the larger class size, Andrew and Kelly taught the students collaboratively and simultaneously, similar to a model of co-teaching defined by Beninghof (2012). David did not engage with this model of co-teaching. The impact of this difference will be described in more detail in section 4.3.1. Kelly and Andrew's co-teaching resulted in no submission of Review Forms or field notes for the earlier cycles. For this reason, it made it difficult to gauge the specific date of the third reflection meeting. It could only be determined that this meeting occurred during August 2017.

4.3.1 Mentor-mentee relationship

As Andrew was Kelly's supervisor, an existing professional relationship was already established. However, no such relationship existed between Kelly and David, as David was new to the school. Despite this, there were both differences and similarities in how Andrew and David supported Kelly. Firstly, Andrew and David differed in how each supported Kelly in teaching and managing the combined and larger-sized class. As stated, Andrew co-taught with Kelly, while David was removed from the lesson to conduct the lesson observations. Kelly reported, in a conversation with the researcher [September 20, 2017], that she found the co-teaching approach much more supportive, especially when she was teaching a combined class of her and Andrew's/David's students. Other evidence of Kelly's preference for co-teaching was found in the transcripts. While discussing with Andrew about the students' planning of their infographics, Kelly stated:

> Yeah. Because I really appreciated when you sort of – you did that in a really nice way today. You didn't make me look stupid. But you just sort of stepped in and suggested, "Oh, let's make sure we get our research in our notebook."
>
> [June 7, 2017]

Both mentors engaged with other support mechanisms. Andrew and David both ensured that Kelly understood different concepts, including the ways to use specific learning tools. Examples of this can be seen in the two excerpts below. The first excerpt shows Andrew explaining the importance of having students conducting research on the learning content.

> … it's good to scaffold the time to be like, "We are now doing the research on this." And give them somewhere that you want them to make their notes, be it in their workbook, or be it in a collaborative doc [document], or something like that. So that they've got the information down on the page. And they're not just jumping straight in because that reinforces to them that they need to research. It's not about the end product.
>
> [Andrew, June 7, 2017]

The second excerpt shows David explaining and detailing how to use *Mentimeter*.

David: So you might have great examples of sentences that come through just as they're going through them. So instead of having … yeah. Instead of having a document where they're all accessing and putting my [one] passive voice, you could have passive voices … it's sort of like a noticeboard that scrolls on the board itself.

Kelly: So that's what *Mentimeter* does?

David: That's what *Mentimeter* does. So it's basically a tap on a screen and the kids all have a code like you would with *Kahoot*, and the question comes up, and instead, they type their own answer on to it and it pops up on the board … and you can highlight examples … you're highlighting also good writing.

Kelly: I was going to say, you can also go, "Oh, here's a great example."

[September 18, 2017]

Another aspect of the mentors' support was the feedback and encouragement provided to reinforce Kelly's behaviours. The example below exemplifies this support.

> I liked how you had everything in *Stile* that was there for the students. I think it made it easy for them to refer back to.
>
> [Andrew, June 7, 2017]

David and Kelly were unable to complete their fifth and final cycle. Due to personal reasons, and because the cycle was towards the end of a school term, David and Kelly did not engage in a final reflection meeting. Despite this difficulty, David provided brief feedback to Kelly via an email, which was forwarded to the researcher. The feedback and encouragement mentioned above can also be seen in the following excerpt from the email.

> I enjoyed when you initiated the *Google Slides* as a way to integrate collaboration and this shows that you were using *Google Slides* for a range of different functions.
>
> [September 28, 2017]

4.3.2 Factors influencing Kelly's integration of technology

As in the previous cases, this section groups evidence of this factor into Kelly's skills and attitudes, her access to technologies, and her students' skills and attitudes.

Kelly's skills and attitudes

The following excerpts show Kelly's skills against the TPACK Framework, organised by the components and themes.

> But at the same time, if we guide the kids to use a template and just make changes to a template, versus maybe the kids who are very confident starting from scratch … (Differentiating learning for students, PK)
>
> [Kelly, June 7, 2017]

> So maybe making sure any groups with kids with iPads were working with another kid with a fully enabled device. Or a school device, or something. (Overcoming technology limitations, TK)
>
> [Kelly, June 7, 2017]

I think again, it's a perfect place just for them to one-stop-shop kind of thing. So if the research questions are in there. If I embed a video, like a how-to video from *PowToon* in there, so that we can watch that as a class as well. So whether or not they've done their weekend homework of playing around, we'll know that at the least, as a base, everybody's seen this five-minute tutorial … So I'll have the video in there, I'll have the research questions, have the links to *PowToon*. Straight to the sign-up page so that they're not trying to go to the wrong spot, and the link to the DFAT [Department of Foreign Affairs and Trade] website. I think just having that. That's one place they know where to find it. And they can also submit. (Using a combination of technologies to facilitate student learning, TPK)

[Kelly, June 7, 2017]

Unless they work in small teams in *Google Docs* which also makes it potentially a lot easier for the students that are not so on top of passive voice. If we make mixed ability groups, they have to do a *Google Doc* in nice, small groups, like a group of three, say, so that they don't sort of sit back and go, “Oh, well, there's enough other people to do the work,” and as a group, they have to do the best recap of camp with a passive voice. (Combining affordances of technology to teach content while considering student grouping, TPACK)

[Kelly, September 18, 2017]

Other evidence of Kelly’s skills against the TPACK Framework can be found in David’s field notes, shown in the example below.

The majority of the lesson was guided by *Smart Notebook* and interactive notebook. This teaching strategy was used to revise and recap previous

> content in order to promote student discussion and collaborative discussion. (Using technology to revisit previous learning, and to encourage student learning behaviours, TPK)
>
> [September 18, 2017]

Access to technology

As described in section 3.3.3, River Primary School was a Bring Your Own Device (BYOD) school, and every student in Year 5 and 6 had their own device to use during their learning. Contingency devices, in the form of iPads, were available when students' devices failed. While direct access to technology was not an issue at this school, Kelly's skills allowed her to consider device and software limitations, as seen in the excerpt below. Kelly was describing a limitation of *Piktochart* on the iPad versus using the application on another device. She followed this by describing the tool's lack of collaborative function as an impediment to group work.

> … one of the technological constraints with it [*Piktograph*] … was the fact that the iPads – they had it, and so I thought, "Yeah. It works on an iPad, no problem." But there were features that were just missing on the iPad … So maybe making sure any groups with kids with iPads were working with another kid with a fully enabled device … instead of wasting 20 minutes trying to play around in *Piktochart* and realising, "Oh wait, you're missing these features." … there was [sic] some issues with the kids, because we did it yesterday and today. And some of the kids that started it yesterday and then were away today, because they've logged in as themselves for the *Piktochart* account and it's not something collaborative, and something you can share, it meant the kids in that group either had to start fresh or we'll have to work on it tomorrow.
>
> [Kelly, June 7, 2017]

Students' skills and attitudes

The references to students' skills and attitudes throughout the transcripts emphasised this as a factor for this case. Examples of students' natural abilities, willingness to self-explore, peer tutoring and monitoring of their own learning can be found in the excerpts below.

> And that's something where we've got to remember that this generation of kids, they're so used to just jumping into technology and just playing with it. You and I are both fairly comfortable with that, as well. But for them, it's second nature. (Students' natural abilities with technology)
>
> [Kelly, June 27, 2017]

> Yeah. I think what I did see was a lot of them were finding their own little features to use in there. (Willingness to self-explore)
>
> [Andrew, June 7, 2017]

> Some groups, I've felt like I've had to do almost nothing to help them. And they weren't even groups of kids you'd think of as really capable, but it's just that they were proactive … They went and checked with another group. So … by the time it came to me, I was like, "There's barely anything here I need to change or–" yeah. (Peer tutoring)
>
> [Kelly, August, 2017]

> And I thought that they were really good at knowing, "We've got to step back. We've got to do the research step, because we pretty much did a similar process with the infographics, the imports." (Self-monitoring learning)
>
> [Kelly, June 27, 2017]

These excerpts provide evidence of the reactions from Kelly's students when she taught lessons that included the integration of technologies.

4.3.3 Factors contributing to the professional learning

This section organises the evidence for the factors that contributed towards Kelly's professional learning. Factors from this school include: mentor capacity; Kelly's reactions to the learning; and educational system and school leadership support.

Mentor capacity

As with previous cases, mentor capacity at River Primary School was assessed by considering the mentors' expertise against the TPACK Framework. Evidence of mentor expertise could be found for Andrew in the components of PK, TK and TPK, and for David in the component of TPK.

> But when it's something they haven't done too much of before, that's when I like to scaffold it lightly. And if you come to a topic later in the year … you might not need to do as much scaffolding … (Advising the necessity to scaffold learning, PK)
>
> [Andrew, June 7, 2017]

> … that's the problem with a lot of third-party websites and things like that, where we don't have an onsite license or anything for it. So we don't have control of it. (Identifying limitations of websites, TK)
>
> [Andrew, June 7, 2017]

> The only other suggestion I would have is, prior to doing the *Piktochart*, is doing a little bit more background work on infographics. And reading them, and analysing them. And we did do a little bit of that in that planning. And we have some examples to show what a *Piktochart* was.

And that *Lego* one that you had was a really good of how it's organised data and things. But I think it might be a good way to link a maths lesson for data representation, as well as geography skills. (Suggestion to scaffold students' learning by developing their knowledge and skills, TPK)

[Andrew, June 7, 2017]

To see increased student autonomy with technology in the future, I feel that the learning sequence needs to be open enough for students to select their own ICT. However during this lesson I understand that it may have been difficult, as this lesson sat alone as a revision session. (Advising for changed pedagogy to include student choice, TPK)

[Email, David, September 28, 2017]

The mentors' capacity was also revealed by the strategies they employed in order to develop Kelly's skills when integrating technologies. The mentors employed a variety of mentoring strategies, such as questioning Kelly in order to elicit deeper reflection on and consideration of her teaching, as seen in the examples below. The first of the following excerpts shows Andrew asking Kelly to plan out her teaching and learning sequence to produce an infographic about trade.

Andrew: So if we think back to what we've learned from implementing the product that we just did, and creating the infographic and the *Piktochart*, what could be a possible timeline or sequence of activities, to lead up to creating the product?

Kelly: Well obviously the research component is vital … Guide them to the right websites … They're pretty good now at knowing to look for .gov, and knowing which sites are a bit more reliable … So I think if we kind of keep in that rhythm, "Here's some suggested places, but you need to have all your research written down in your book." Have very clear research questions for them … And then I don't just want them jumping in *PowToon* straight after that, because there's so much planning … So if we have them actually, sort of, storyboard that for us. On draft paper, in *Google Docs*. However works for them. And show a teacher … And that will avoid it just becoming a jump in, and get confused and lost. I think that would – what do you think?

Andrew: Yeah. No. I think that sounds like a good plan. And I like how – the giving explicit time for research as well.

[June 7, 2017]

The second excerpt is a discussion between David and Kelly regarding the implementation of more open-ended tasks.

David: The students are going to be very self-directed in their lesson because it's on *Stile*. It's going to be open-ended because they're working – well, is it going to open-ended enough, though?

Kelly: To some extent. I mean, it's not like there's one answer that's going to be correct. Obviously, it's …

David: So can we build into it some idea where it's open-ended using technology because it's going for a whole hour this lesson. So you're going to recap on *Stile*, active and passive [voice], then you're going to go back through, and you're going to look at changing slogans using a collaborative document. And then from there, should we build in an open environment?

Kelly: I think it would be nice if they did a sort of a recap of what they've done during the term. But in a funny twist, they have to write in the passive voice and that could keep it quite open.

[September 18, 2017]

Another strategy evident at this school was the identification of achievable milestones by Andrew and David. The examples below were chosen to depict the way in which both the mentors identified and negotiated milestones with Kelly. The data revealed that only Andrew reviewed previous milestones with Kelly. The mentors also provided Kelly with strategies to achieve these milestones.

So four things we'll focus on tomorrow, sharing resources between students and teachers, but you're going to do that through your *Stile*; providing opportunities for students to share their learning with an authentic audience, so that's going to happen also through *Google Slides* or your *Mentimeter*, if you do that. (Identifying appropriate milestones)

[David, September 18, 2017]

Kelly: And you talked about collaboration …

David: Yeah. Collaborating as well. I think if we can collaborate in a document with the students through *Google Classroom* – no, through *Google* –

Kelly: *Google Slides*, maybe, could work out for that.

David: *Google Slides*. Yeah, correct. I'm just saying that would fit in – we could announce again – so learning is open-ended and technology is used to explore directions that learning is taking. By using that, that could be a way of having an open-ended task where students navigate through, collaborate together for an output, I guess. And that way, using a whole different range of technologies too, not just one … They can go and review themselves, but you as a teacher are also going back and reviewing it as well.

Kelly: And maybe even at the end of the lesson, we could have a look at what we created as a class. If they work on the slides together … That could be good.

(Negotiating milestones)

[September 18, 2017]

So how do you think the day went? So we talked about last time [during] the planning, and things like that that you were planning on doing. And I think that was good, the storyboarding and all that worked. So if we just start at the beginning and go through, how did you think it all went today? (Reviewing milestones)

[Andrew, June 27, 2017]

And maybe some good and bad examples of *Piktocharts*. Not *Piktocharts*, of infographics. That might help them design their own better, because a lot of them would have seen these types of displays before, but they haven't used them or created them themselves. So that could just be one area that I think would make it a little bit more – could make theirs more authentic. More real. (Providing strategies)

[Andrew, June 7, 2017]

One mentoring strategy that David used, which Andrew did not, was to use the framework to identify milestones for Kelly, as seen in the excerpt below.

I think that would hit the *File* or *OS* [*File Management and Operating System Use*], Advanced: Stage 4 if you're sharing files and resources with the students which will be a great idea. So that could be a tie that we work on for next lesson. So sharing media files with students.

[David, September 18, 2017]

The extracts in this section showed that the mentors provided varied approaches to support Kelly in identifying and reviewing milestones, and ways for her to achieve these.

Kelly's reactions to the learning

Kelly's reaction to her learning shows other factors that influenced her development. One of Kelly's reactions to the mentoring was already seen in section 4.3.1, where she showed appreciation for Andrew's hands-on mentoring. Also evident was Kelly's receptiveness to the mentoring. This is seen in the first of the following excerpts, where Kelly accepted advice from Andrew regarding how to overcome any inappropriate still images at the end of *YouTube* clips.

Yeah, perfect. That's a good tip for next time. (Receptiveness to mentor advice)

[Kelly, June 7, 2017]

The other excerpts provide examples of other behaviours that Kelly exhibited, which are unique to the case at River Primary School. The second excerpt shows Kelly asking David for strategies to make a poster design task more interactive.

So I don't know if you've got a suggestion for how we could make that a bit more interactive perhaps. (Asking mentor for strategies)

[Kelly, September 18, 2017]

The third excerpt shows Kelly asking David to clarify a function of *Mentimeter*.

> Can they edit something they've written? (Clarifying with the mentor)
>
> [Kelly, September 18, 2017]

The final excerpt shows Kelly asking Andrew for feedback.

> Did you want to talk about anything you noticed about the lesson today? (Asking mentor for feedback)
>
> [Kelly, August, 2017]

These excerpts provide evidence of Kelly's behaviours and reactions to her mentors' advice and suggestions, both of which contributed to her professional learning.

Educational system and school leadership support

The theme that emerged in relation to educational system and school leadership support at this school was a lack of time for the teachers to be released for observations and to conduct the reflection meetings. The issue of the lack of time to engage with the professional learning was communicated in emails from both the mentor and the mentee to the researcher, as seen below, and from the participants' survey responses, as seen in Table 4.3.1.

> As the project did not come with extra funding we made do by completing the 'observations' during our team teaching time and meetings in our time after/before school.
>
> [Email from Andrew, August 28, 2017]

> It's just an issue of not being able to have the meeting right afterwards. This is always the case, given that we do not get RFF or any additional time for this project, thus why our debrief/meetings are always after the fact, whenever we can find a time to meet.
>
> [Email from Kelly, September 19, 2017]

4.3.4 Results of the professional learning

This section organises the evidence relating to the results of the professional learning into two categories: Kelly's growth and development, and students' reactions. The figures in this section, as indicated in this chapter's introduction, are included so that the Kelly's skill levels throughout her engagement with the study can be identified. In this section, this can be done through identifying the highlighting in each figure. The specific colours of highlighting that should be noted are:

- the yellow and blue highlighting in Figure 4.3.1
- the dark highlighting in Figure 4.3.2
- the yellow highlighting in Figure 4.3.3.

Figure 3.2, the draft framework, provides a detailed description of the access points highlighted.

Mentee growth and development

Evidence of Kelly's growth and development came from the tracking of her achievement against the framework. Due to the change of mentors, Andrew was requested to record Kelly's achievement after his last observation to assist David's adoption as Kelly's new mentor. While David had access to Andrew's data submissions through *CloudStor*, it appears that David did not access these, as David remarked during a conversation with the researcher that he did not receive any information from Andrew [September 20, 2017].

The figures below show Kelly's beginning level (Figure 4.3.1, highlighted in yellow), the level at mentor changeover (Figure 4.3.1, highlighted in blue, and Figure 4.3.2) and Kelly's finishing level (Figure 4.3.3). Figure 4.3.1 shows a shift in Kelly's achievement level, where she achieved in Stages 4 and 5 when Andrew finished as her mentor. However, lower levels are seen in the figures that captured achievement at both the time of when David took over as mentor (Figure 4.3.2) and at the end of study (Figure 4.3.3). It appears that Figures 4.3.2 and 4.3.3 show similar achievement levels. A discussion between David and the researcher [September 20, 2017] suggested that a mentee's achievement level may vary based on the technologies used and the curriculum content being taught.

Continuum on teacher's capacity to integrate information and communication technologies (ICT) in classrooms

	Stage 1 **Substitution**	Stage 2 **Supported**	Stage 3 **Interactive**	Stage 4 **Advanced**	Stage 5 **Synergy**
File management and operating system use (OS)	Utilises some form of technology in classroom. (OS1a) Able to locate digital files and software for use in classrooms. (OS1b)	Uses third party teaching strategies, e.g. premade Notebook files, and lessons are lineal. Deviation from pre-planned content is not evident. (OS2a) Teacher sources references, materials and other supporting documents from other sources, e.g. collegial sharing on school server or on the internet. (OS2b)	Able to flip between different software, websites and other sources in support of lessons. (Multitasking) (OS3a) Teacher is familiar with premade teaching content and, as such, lesson pace is improved. This includes retrieving different information and support materials with ease. (OS3b)	Shares resources between students and teachers – e.g. collective media files, pictures, information. (OS4a) Teacher provides opportunities for students to share learning with authentic audiences (e.g. emailed to teacher/s for review, present at interactive whiteboard, video conference outside school environment, collaborative blogging). (OS4b)	Teachers and students share ownership of all ICT within the classrooms and share responsibility of using these technologies in classroom learning. Members of the classroom share their expertise with each other, mentoring each other on the use of ICT to enhance learning. (OS5a) Teacher is removed as expert or owner of ICT in the classroom and work as a mentor and facilitator for students in ICT uses. Students dictate the use of ICT across all curriculum (OS5b)
Mechanical skills (MS)	Uses devices as presentation tools, such as projecting images through the projector only. (MS1a) Files created in lessons are saved, but not referred to (i.e. treated as separate lessons) (MS1b)	Students utilise devices to word process/write, highlight or drag. (MS2a) Limited utilisation of pre-made secondary software (e.g. Mathletics, Reading Eggs) (MS2b) Support images and other basic support documents are used only as decoration or peripheral support, rather than core instruments for driving lesson ideas. (MS2c)	Students use ICT to assist with conceptual learning across Learning Areas. (MS3a) Uses a wider range of media sources (including Internet, digital camera and scanner) to accentuate curriculum and not for 'decoration'. (MS3b) Shares lesson ideas, media, files with others. (MS3c) Premade and saved documents acknowledge the continuation of learning and may be referred to in current and future learning opportunities. (MS3d)	Continued ICT use by students evidenced by student's confidence and natural use of technologies. (MS4a) Different technologies and a variety of their affordances are interwoven with curriculum learning. (MS4b) Learning is open ended and technologies are used to explore the direction that learning is taking. (MS4c)	Teachers and students confidently use known technologies together. (MS5a) Teacher and students explore further affordances of current and emerging technologies together. (MS5b)
Program variables (PV)	Lessons taught uses core tools of portable devices for their basic functions, i.e. camera in iPad to take pictures. However, tools used adds little to lessons (e.g. photos may be taken to record other learning and not used for lessons themselves) (PV1a)	Uses the core tools as before but now using as part of a lesson (e.g. pictures taken from camera may be used in a literacy lesson) (PV2a)	Teacher takes opportunity to use different affordances of technologies experimentally and with increasing confidence to support the learning of the curriculum. (PV3a)	Complex and media-rich resources are collaboratively shared across networks (e.g. outside of school environment). Collaborative development of resources is evident across networks. (PV4a) Teachers develop strategies to enhance pace of lessons by using ICT affordances. (PV4b)	Authentic audiences and collaborative learning are evident in the learning space. Collaborative projects play a significant part of students' learning, which may include projects across groups, schools and countries. Students and teachers seek information from a variety of sources around the world, including experts in fields. (PV5a) Students, teachers and the greater learning community share in the learning of the students. The greater learning community has the opportunity to respond and add to students' learning. (PV5b)
Classroom management and pedagogy (CMP)	Digital tools are only used by teacher. (CMP1a) Lessons are paced identically as to those without technology (CMP1b) Maintains eye contact with class. (CMP1c) Teacher presents information, and response from students is through questioning by teacher using the initiate-response-feedback model. (CMP1d)	Students' use of devices strictly planned by teacher and is restricted to technical features such as drag and reveal. (CMP2a) Used most commonly in teaching of core subjects (i.e. English and Mathematics) (CMP2b) Metalanguage of ICT is used naturally within lessons. (CMP2c) ICT is used to support text-based, teacher directed learning. (CMP2d) ICT is used as a reward for main learning. (CMP2e)	Teacher initiates and plans opportunities for students to select ICT. (CMP3a) Uses ICT in a growing range of subject areas, including music, history etc. (CMP3b) The use of ICT is increasingly spontaneous and is used spontaneously in response to learning e.g. directing students to answer spontaneous questions using ICT. (CMP3c) Teachers experiment in blending ICT to differentiate learning and to support the development of literacy skills and of deeper knowledge and understanding. (CMP3d)	Use of revised and improved versions of previous lessons with emphasis on curriculum, rather than technical ability. (CMP4a) ICT is used successfully to sustain dialogue and to demonstrate learning. (CMP4b) Teacher uses online social networking to improve pedagogy and get teaching ideas. (CMP4c)	Teacher demonstrates an intuitive interaction with technology, which effects fluidity in lesson structure, including differentiation of lessons and assessment for, of and as learning. (CMP5a) Teacher and students have equal say to dictate the direction, momentum and scale of the lesson. (CMP5b) Independent reflection of learning includes ICT-rich tools. (CMP5c) Teachers, other educators and experts work collaboratively to share ideas, review lessons and develop new learning that synergistically blend a variety of quality resources, assessment tasks and activities. These emphasise the use of ICT in new, innovative and creative ways. (CMP5d)

Figure 4.3.1. Kelly's beginning and mid-study levels (by Andrew)

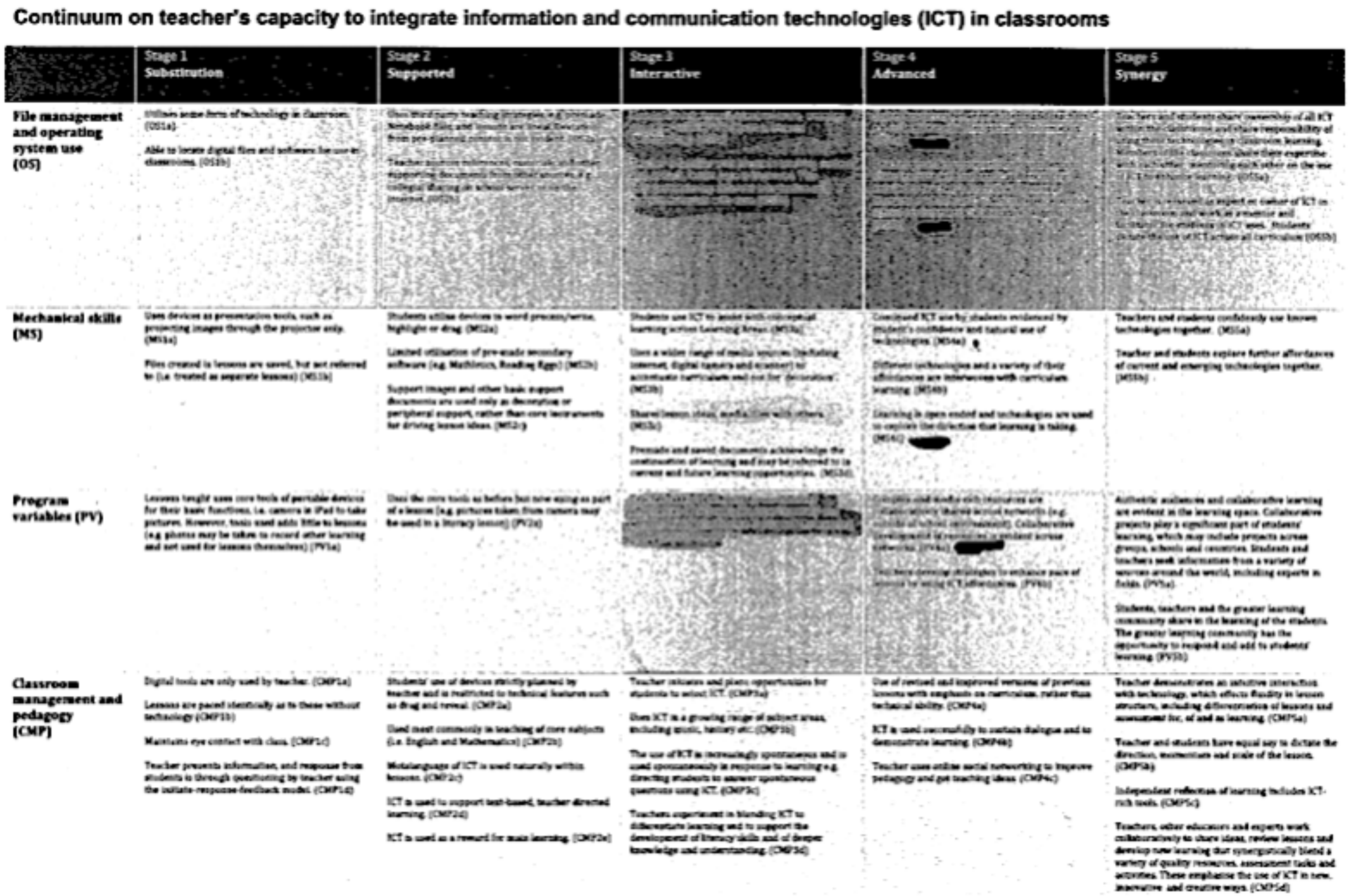


Figure 4.3.2. Kelly's mid-study achievement, at change of mentor (by David)

Figure 4.3.3. Kelly's end of study achievement (by David)

Students' reactions

Further evidence of the impact of Kelly's professional learning was with respect to students' reactions to Kelly's lessons. These reactions included the students' enthusiasm and engagement, which can be seen in the excerpts below.

> Okay. But apart from that, I thought they were all really excited to start their infographics. (Student enthusiasm)
>
> [Kelly, June 7, 2017]

> Everyone was really engaged all day. (Student engagement)
>
> [Andrew, June 27, 2017]

Some new themes in the category of students' reactions emerged from River Primary School. The themes included students' reactions to seeing links with previous learning, increased students' learning independence and students being able to show teachers new ways to use a technology.

> … the link of how an infographic relates to the book we did: *If the World Were a Village of a Hundred.* So I think that really connected with the kids, because it was something they'd just been doing. So they kind of went, "Oh, cool. I can see how that connects to the infographics". (Linking previous learning)
>
> [Kelly, June 7, 2017]

> … one of the boys in the class, who is the kind of kid that is very diligent, he ticks every box, but he's not very good at thinking for himself. And he's someone I worried about a little bit. You know, "Is he going to get this?" Or is he going to be constantly asking me, "Where do I find this? Where

do I find this?". He asked me one question once, and his group by the end of the day had almost finished theirs. They'd done everything except the voice-over and it looked fantastic. (Student's independence in learning)

[Kelly, June 27, 2017]

Andrew: And a few of them were teaching me some things to do.

Kelly: Yeah. Absolutely.

(Showing teachers new skills)

[June 27, 2017]

As in the previous cases, these extracts provide evidence for the change in students' behaviour as a result of lessons more integrated with technologies.

4.3.5 Feedback on the toolkit

The tables in this section group the feedback on the toolkit in the same way as for the previous cases. Andrew provided his response to the survey at the end of his mentoring, while David and Kelly submitted their responses at the end of the case study.

Table 4.3.1

Case 3: Survey responses relating to previous themes

Theme	Question	Andrew	David	Kelly	Qualitative
Support	My mentor: [Q3.1]				
	was supportive.	N/A	N/A	Strongly agree	*Nil*
	was available for support.	N/A	N/A	Strongly agree	*Nil*

Theme	Question	Andrew	David	Kelly	Qualitative
Mentor expertise	My mentor: [Q3.1]				
	is well-versed in integrating ICT in classrooms.	N/A	N/A	Strongly agree	*Nil*
	adequately identified my level of understanding for integrating ICT.	N/A	N/A	Agree	*Nil*
	facilitated my learning progression.	N/A	N/A	Agree	*Nil*
	The process/framework: [Q3.3]				
	has helped me improve my integration of ICT.	Disagree	Disagree	N/A	*Nil*
	has added to my knowledge of the potential of ICT in education.	Agree	Agree	N/A	*Nil*
	was beneficial to me as the mentor.	Agree	Agree	N/A	*Nil*
	Other comments: NB I had two different mentors throughout (one left the school). [Kelly]				
Educational system and school leadership support	The process/framework:				
	was manageable in terms of time. [Q3.3d]	Disagree	Agree	Disagree	*Nil*
	Were you afforded more time to observe and meet your mentee? [Q3.5]	No	No	N/A	Time to meet the mentor, not in our own time, would have been of more benefit. Additionally, the only way the mentee was able to be observed was in a team teaching environment. [Andrew]

Theme	Question	Andrew	David	Kelly	Qualitative
					Definitely would be more beneficial and could fit in with QTSS time and PDP goals. [David]
	Other comments: It was difficult to complete this without funding as it had to be done in teachers' own time. We often spent hours after school debriefing/planning sessions. At times of staff turnover and stress, it felt like an extra burden. [Kelly]				
Mentee growth and development	My mentee was: [Q3.1]				
	eager to shift and demonstrate growth according to the framework/process.	Strongly agree	Agree	N/A	*Nil*
	receptive to my suggestions.	Strongly agree	Agree	N/A	*Nil*
	an active participant in the partnership.	Strongly agree	Agree	N/A	*Nil*
	Other comments: The mentee was eager to develop her skills to better design and conduct learning experiences to maximise learning opportunities. She was adaptive to change and actively engaged in the mentor/mentee process. [Andrew] She [Kelly] had a strong starting point with ICT, but still needs more exposure to productive ICT within the classroom. [David]				
	The process/framework: [Q3.3]				
	has helped me improve my integration of ICT.	N/A	N/A	Agree	*Nil*
	has helped me change my teaching pedagogies.	N/A	N/A	Disagree	*Nil*

Theme	Question	Andrew	David	Kelly	Qualitative
	has added to my knowledge of the potential of ICT in education.	N/A	N/A	Agree	*Nil*
Students' reactions	After the study: [Q3.5]				
	my students are more engaged due to my ability of ICT integration.	N/A	N/A	Agree	*Nil*
	my students are attaining more learning outcomes due to my lessons being more enriched by ICT.	N/A	N/A	Disagree	*Nil*

QTSS: Quality Teaching, Successful Students - A NSW staffing resource allocation to improve the quality of teaching (NSW Department of Education [DoE], 2018h)

PDP: Performance and Development Plan: A plan aligning with the *Performance and Development Framework for Principals, Executives and Teachers* in NSW Public Schools (NSW Department of Education, 2016)

Table 4.3.2

Case 3: Participant intentions after the study

Question	Andrew	David	Kelly
After the study: [Q3.7 (mentor) and Q3.5 (mentee)]			
I will continue to use the framework.	Agree	Agree	Disagree
I am happy to mentor other colleagues. (Mentor)	Agree	Agree	N/A
I feel confident in mentoring other teachers in integrating at least some aspects of ICT. (Mentee)	N/A	N/A	Agree
Other comments: No longer at school, but if I was I would continue working with the mentee. Framework could be useful in the future working with new scheme teachers. [Andrew]			

Table 4.3.3

Case 3: Participant feedback regarding the process and framework

Question	Andrew	David	Kelly
My mentee and their skills were easily identified on the framework. [Q3.1b]	Agree	Agree	N/A
The process and framework: [Q3.3]			
gave me the tools to provide practical advice to my mentee.	Agree	Agree	N/A
made it easier to mentor, given the explicit instructions and instruments.	Agree	Agree	N/A
has useful instruments important to the process.	Agree	Agree	Disagree
is cost effective.	Disagree	Agree	Agree
has been a greater benefit than a one-off course.	N/A	N/A	Disagree
was easy to follow.	Agree	Agree	Disagree
Other comments: I think this has potential but needs to either come with some kind of school funding (e.g. to provide RFF for teachers so that they don't spend their own time working on it), and mentor/mentee should be carefully matched. [Kelly] Perhaps easier language for teachers to decipher. [David]			

Table 4.3.4

Case 3: Consolidated feedback regarding the framework and the process

Framework	▪ Language of the framework needs to be more ‘teacher friendly’
Process	▪ Having a single mentor was preferable. However, the two mentors provided different expertise. ▪ Transition would have been assisted if David engaged with more action research cycles ▪ The formality of the data gathering added stress to the process. The process felt like it was an additional responsibility, especially for Kelly who was new to the school.

4.3.6 Summary of River Primary School's case study

River Primary School was the third school to implement the professional learning toolkit. Andrew, Kelly's first mentor, and Kelly built their mentor-mentee relationship on an established supervisory relationship. Kelly and David, Kelly's second mentor, also built on a supervisory relationship, but this was only recently established at the time of the case study, as David was new to the school. Despite the difference in the relationships, both Andrew and David engaged with a variety of similar mentoring strategies in order to facilitate Kelly's growth when integrating technologies.

The mentors, however, approached their in-class support differently. To accommodate for the lesson observation, the two Year 5 classes were combined into a much larger class of nearly 60 students. Kelly was more appreciative of Andrew's co-teaching approach, as this assisted the teaching and the management of the large class. David, however, observed the lesson away from the teaching and learning, leaving Kelly to take sole responsibility in teaching the class.

While this difference in the in-class support impacted on Kelly's perception of mentor support, as will be discussed in the following chapter, Kelly's lessons resulted in the Year 5 students being more engaged with the learning, reacting with enthusiasm to the lessons and demonstrating increased learning independence.

Case 4: Edge Primary School

The following sections present the fourth case study, at Edge Primary School, in similar categories to those identified in the previous cases. As was the case at River Primary School, Debbie, the mentee, had two mentors – Jennifer and Sarah. The mentoring with Jennifer used the Mathematics syllabus as the primary content driver, while Sarah focused the mentoring on using the English syllabus. However, Debbie also taught from the Geography curriculum towards the end of this case study. As Jennifer, the first mentor, moved interstate after the second cycle, there was some difficulty receiving all the data. For this reason, the date of the first observation could not be specifically determined. However, it can be confirmed that the first observation happened in June 2017.

4.4.1 Mentor-mentee relationship

While both Jennifer and Sarah were teachers in the school with Debbie, the established professional relationship differed between Debbie and the two mentors. Jennifer took on the mentoring to support her achievement of a higher accreditation level, as was briefly mentioned in section 3.3.3 and which will be described in greater detail in section 4.4.3. Sarah was already working as the literacy coordinator at the school, with a focus on classes in Years 1 and 2. As such, Sarah was already adopting a mentoring and supervisory role with Debbie, who was teaching Year 2. Despite the differences in the relationships, there was evidence of an established rapport between Debbie and each of the two mentors, as seen in the examples below. The evidence is seen in the relaxed interactions throughout the transcripts, which are supported by the informal tone in the audio recordings. The first example relates to Debbie's students' reactions to having Jennifer in the classroom.

Jennifer: Look, I think it [the lesson] was lovely. It's so nice being in a Year 2 classroom again.

Debbie: Oh, thank you [laughter]. I know they're really excited to have visitors.

[Debbie, June, 2017]

The second example was about the students' use of iPads.

Sarah: So I learned a few things [laughter]. I learned how I could – I hadn't screenshotted before [laughter].

Debbie: Oh, well, I'm glad. I'm glad.

[Sarah, October 12, 2017]

The positive relationships between the two mentors and Debbie facilitated the mentors in providing support for Debbie's learning and development. This support can be seen in the encouragement and feedback provided to Debbie by both mentors, as depicted in the examples below. The first example relates to Jennifer providing positive feedback on Debbie's use of technical language throughout her lesson.

> They asked you questions and clarified their understanding of what they had to do at each station, and I noticed that you were using far more technical language in terms of logging on, using passwords, finding *Chrome* – that more technical technology language – and what they had to do, which was really good.
>
> [Jennifer, June 16, 2017]

The second example shows Sarah commenting on the efficiency of the literacy groups that integrated several different forms of technology.

So to me, coming in, off the bat, it looked like a process that's built in. Even when they pack them up, the kids knew who packed them up, and who carried them back, and stuff like that. And a few things that I noticed was that they talked about-- they used some of the technology terms, some ICT terms, to me, that they used. One student told me about *Seesaw*. I said, “What are you doing?” and they said, “Well, we're recording ourselves on *Seesaw*,” and I said, “Well, what do you do next?”, “There. There it is. I've just uploaded it,” and so they were using those terms and doing it fairly confidently on their own. They weren't coming to you to double-check the process at all.

[Sarah, September 21, 2017]

These extracts provide evidence of the relationships existing between Debbie and her two mentors.

4.4.2 Factors influencing Debbie’s integration of technology

As in the previous cases, this section organises the factors that influenced Debbie’s integration of technology into categories based on her skills and attitudes, her access to technology, and her students’ skills and attitudes.

Debbie’s skills and attitudes

The excerpts below demonstrate Debbie’s abilities in the PK and TPK components. The first example shows Debbie reflecting on whether she needed to teach her students how to take photos, and shows her PK.

No, it wasn't till later that I thought of that. But then they probably did already know [laughter]. (Knowledge of students’ abilities, PK)

[Debbie, June 16, 2017]

The next two examples show Debbie's TPK, where she used different technologies to support teaching and learning, and overcame the limitations of the technologies by reorganising her students into new groups.

> Both were a retelling kind of activity. The iPads, when they had to speak into it. Yeah, they were retelling. Although, they were telling me about the book. And then on *Studyladder*, they have lots of different comprehension activities. So you can choose a text and it asks questions about [inaudible] comprehension and retelling for that as well, so. And that was all differentiated as well, so you can choose the stage and what group they go in. (Supporting teaching and learning with technology, TPK)
>
> [Sarah, September 21, 2017]

> *While discussing the difficulties when students tried to connect to Google Earth and Google Maps:*
>
> Debbie: Apart from the iPads not connecting properly, I …
>
> Sarah: And that only took three minutes, maybe? Three, four minutes. And then gradually by the time you'd organised them to work in pairs …
>
> (Overcoming technologies' limitation through student grouping, TPK)
>
> [October 12, 2017]

Debbie indicated during a conversation with the researcher [September 21, 2017] that, as a result of the mentoring, she was more confident with technology integration and found integrating technology more manageable.

Access to technology

The data from Edge Primary School show that Debbie had good access to iPads. The limitations of this factor were seen in iPads which were not ready for use, problems with connecting to the school infrastructure, and limitations of the applications Debbie wanted to use. Examples of these limitations are seen below.

> But it was good in the sense that you had so many iPads, and they were using them in the group, that you could quickly go and get another one. (Technology availability)
>
> [Jennifer, June 16, 2017]

> And there's always that annoying, “Oh, this one's not charged,” or “This one's for some reason not jumping onto the Wi-Fi.” (Technology not ready for use; Issues with connectivity)
>
> [Jennifer, June 16, 2017]

> Oh, that's really good. Yeah, the signing out every 15 minutes of *Mathletics* is frustrating. And that must be even frustrating if we get the kids onto *Mathletics* individually, for a course of a lesson – (Application not functioning)
>
> [Jennifer, June, 2017]

The final example in this section shows that the problem of connectivity to the school network was intermittent.

> Sarah: And there didn't seem to be any of the wireless issues in your classroom –
>
> Debbie: No, not this time. Only a couple. (Intermittent connectivity issues)
>
> [November 11, 2017]

This evidence reveals the realities of the limitations relating to technology access for Debbie and her students, impacting on their use of technologies for teaching and learning, and Debbie’s ability to integrate technologies.

Students' skills and attitudes

Students' skills and attitudes were other factors that influenced Debbie's integration of technology. Only one of the themes evident at this school from this category of factors existed in the previous cases, which was students' willingness to support their peers. New themes emerged from Edge Primary School. These were students' ability to adapt to different teachers and students' existing skills. The first of these new themes was revealed in a conversation with Debbie [September 21, 2017], where she explained that, since she was a part-time teacher, the students had two teachers. Debbie stated that students had less exposure to technology integration with the other teacher, but the students did not have any problems with sustaining their technology skills when Debbie was teaching the class. Examples of the other themes can be found in the excerpts below.

Debbie: I saw a lot of kids helping each other on the iPads, which was really nice.

Jennifer: Yeah. It was really nice. Yeah. And as soon as they sat down, they weren't afraid to ask each other questions or say, "Oh, I can't do this. I can't get on or –", yeah. So that was really good. So much more collaboration in their learning, which was really cool.

(Peer support)

[June 16, 2017]

Sarah: So what I saw was that they knew how to use the iPad technology. You didn't have kids coming up to ask you questions about it and when a few kids came across issues with it, they kind of did tend to figure it out a little bit themselves.

Debbie: Yeah, they've been getting better and better [laughter].

Sarah: Yeah, well she said, "Oh, this isn't going to work very well." I said, "Oh, what could you do? Have a [inaudible]," and she kind of turned herself around on the side of the desk so that she could figure out to get the best recording and the best light [laughter]. [Student1], yeah, and [Student2]. Like [Student2] says they were looking for their folders and they couldn't figure it out and [Student2] said, "You've got to put it on the reading group folders." So to me, they seem to be quite practiced in the iPad use and the *Seesaw* use. And someone said to me, "I just commented on something that someone else had done."
(Students' existing skills)

[September 21, 2017]

These extracts show how the skills and attitudes of Debbie's students can impact on her ability to integrate technology into teaching and learning in her learning spaces.

4.4.3 Factors contributing to the professional learning

The factors from Edge Primary School, as seen below, that contributed to the professional learning included: mentor capacity and motivation; Debbie's interactions with the learning process; and educational system and school leadership support.

Mentor capacity and motivation

The following excerpts provide examples that indicate Jennifer's skills in the PK, TK and TPK components.

When noticing students were skimming questions in Mathletics:

So, yeah, I thought that was interesting that she did that. And that, again, is a literacy skill issue too, because perhaps the kids who are a bit more confident reading possibly skim and scan the questions fine. (Considering students' abilities, PK)

[Jennifer, June 16, 2017]

So *Seesaw* might be a really great way. *Seesaw's* good because you don't need, really, to log in. It's a bit like *Recap*. You have a class PIN or a QR code, and they scan that and they're in. So it's really handy. No logins and passwords. (Knowledge of an application, TK)

[Jennifer, June 16, 2018]

During a discussion about reading different modes (text versus image):

So then I thought, "Ooh, that's interesting." Maybe then that's a little teaching point for later on. Like, looking at questions and not always assuming that although visually the screen looks similar – written text; image – that it might not always be asking you the same thing. (Using TK when teaching curriculum outcomes, TPK)

[Jennifer, June 16, 2017]

There was little evidence of Sarah's expertise against the TPACK Framework, as the joint reflection and planning methods of her mentoring style focused more on Debbie's skills and did not give much opportunity for Sarah to demonstrate her own expertise. Sarah's expertise was mostly seen in her recognition of Debbie's skills, which is exemplified by the excerpt below. This is followed by a more obvious example of her TPK.

> So I thought it was a really good integration of the ICT because that was their visual– well, it was really visual literacy as well, because that was their maps supporting their writing that they did about– they had to write a little bit about the connection on the map. So I think it was really, really integrated well, because that formed part of their written response. (Recognising Debbie's TPK, TPK)
>
> [Sarah, October 12, 2017]

> There's stuff like that where you can actually– the kids can write their story with their visual sequences. They can photograph their story and put it on there and then talk about the event that goes with it. (Discussing apps on the iPads, TPK)
>
> [Sarah, September 21, 2017]

A new theme concerning the need to develop the mentor's skills emerged from Edge Primary School. The mentors' learning from Debbie's lessons became evident in different reflection meeting transcripts. This is exemplified in the following excerpt.

> Same here [laughter]. It's good. No, it's nice sitting up the back going, "Ooh, I'll steal that idea, and that idea." And then whilst I'm reflecting on where you are at, I can't help but reflect on where I am at, which is really nice.
>
> [Jennifer, June 16, 2017]

The next example shows Sarah's suggestion of the need to get support from another teacher in the school.

> And we might be able to ask [Teacher]. She's got some admin time and we might be able to ask [Teacher] to kind of well, I'll need support from– if I was going to start using *Google Classroom*, I'd need support myself as a mentor.
>
> [Sarah, September 21, 2017]

Jennifer further demonstrated her mentoring capacity through a number of strategies, including questioning Debbie to elicit reflection and ideas, and explaining concepts to ensure understanding. These excerpts are in relation to photos the students took during the lesson.

> So what are you going to do now that you have those pictures? (Questioning)
>
> [Jennifer, June 16, 2017]

> And then you can share their work with them, and then they can share their work as well. So *Seesaw's* like a digital portfolio. So then, too, if you have a bank of iPads in the room, or anything with a camera at all, at any point they can choose to take a picture of that. They don't need your permission to do it. "I've just done this. I think this is pretty cool. I'm going to grab a picture of it, and I'm going to –" (Explaining concepts)
>
> [Jennifer, June 16, 2017]

As with the previous cases, mentor capacity also manifested itself here in establishing milestones for and providing strategies to the mentee. At Edge Primary School, there was evidence of the mentors identifying and, in Jennifer's case, reviewing milestones with Debbie. The excerpts below provide examples of these behaviours, as well as of the mentors using the framework to identify milestones.

Jennifer: … shares resources between students and teachers, collective media files, pictures, and information … what do you think that would be?

Debbie: Well, in the *StudyLadder*, because it is … I guess it's kind of in between the *StudyLadder* … it's like *Mathletics*; you can assign certain things … So I could assign different tasks to different students, but today I just shared the same one.

Jennifer: They did the same. Yeah, that's right. Yeah.

Debbie: So it's kind of getting there. I'll have to have a think … (Identifying milestones)

[June 16, 2017]

… we have also highlighted [on the framework] 'Teacher takes opportunity to use different affordances of technology experimentally and with increasing confidence to support the learning of the curriculum' … No, again, this is just a snapshot in time. This is just the things that I observed in that lesson. But, yeah, I think you did do that this week. (Reviewing milestones)

[Jennifer, June 16, 2017]

And share responsibility in classroom learning. Yeah. Yeah. Well, why don't we pop that one down to OS5a? (Using the framework to identify milestones)

[Sarah, October 12, 2017]

Both mentors provided Debbie with appropriate strategies to help her meet the milestones. The excerpt below exemplifies this behaviour for both mentors. In this example, Sarah and Debbie were discussing how to use the iPads to support the students when writing a narrative.

Sarah: … what if we play around with the iPad camera? Because they're already really confident with the iPad use.

Debbie: Yeah. And the camera.

Sarah: So what if the next lesson I come in is when you're kind of just there recording their pictures for the narratives or something and trying to add some …

Debbie: Into a story-making?

Sarah: … you can make out their dialogue and we just get that recorded. We get the pictures recorded … There's *Little Bird Tales* that I'm thinking.

[September 21, 2017]

As previously indicated in section 3.3.3, Jennifer and Sarah's motivation for participating in this professional learning model differed. Jennifer adopted the mentoring with the aims both of supporting Debbie in achieving her Proficient level of teacher accreditation, as well as providing structure for herself to achieve a higher level of accreditation. Sarah, as seen below in Table 4.4.2, initially took over as the mentor as a favour for Jennifer. However, she was willing to mentor Debbie, hoping to establish a 'learn together' model for using technology in literacy teaching and learning. Similarly, in a conversation with the researcher [September 21, 2017], Debbie reported that she and Sarah were working together to build technology integration skills, but she was also able to access Sarah's expertise in teaching literacy. It appears that both mentors were motivated to adopt the mentoring based on mutually beneficial scenarios.

Debbie's reactions to the learning

As seen below, Debbie's reaction to the professional learning was exemplified by two behaviours: her positive attitude towards the mentoring and receptiveness to the mentoring provided.

While talking about Debbie's development:

Jennifer: So yeah. No, I think it's going good.

Debbie: It is. And I'm learning a lot too.

(Positive attitude towards the mentoring)

[June 16, 2017]

As Jennifer discussed Debbie's achievement:

Yeah, getting there. And beginning [from the framework] 'Teachers experimenting and blending ICT to differentiate learning and to support the development of literacy skills and a deeper knowledge and understanding'. Yeah, I would agree. Beginning, and getting there. (Receptiveness to mentor advice)

[Debbie, June 16, 2017]

These behaviours, as previously indicated in other cases, might affect Debbie's ability to develop throughout her engagement with the professional learning model.

Educational system and school leadership support

While the professional learning model was underway, this factor did not affect Debbie's development or her engagement with the process. However, during the break in the mentoring at Jennifer's departure, there was a change in principal at the school. Debbie reported that it was difficult to maintain the momentum of the mentoring, as she needed to explain the process to the new principal and gain their support [September 21, 2017].

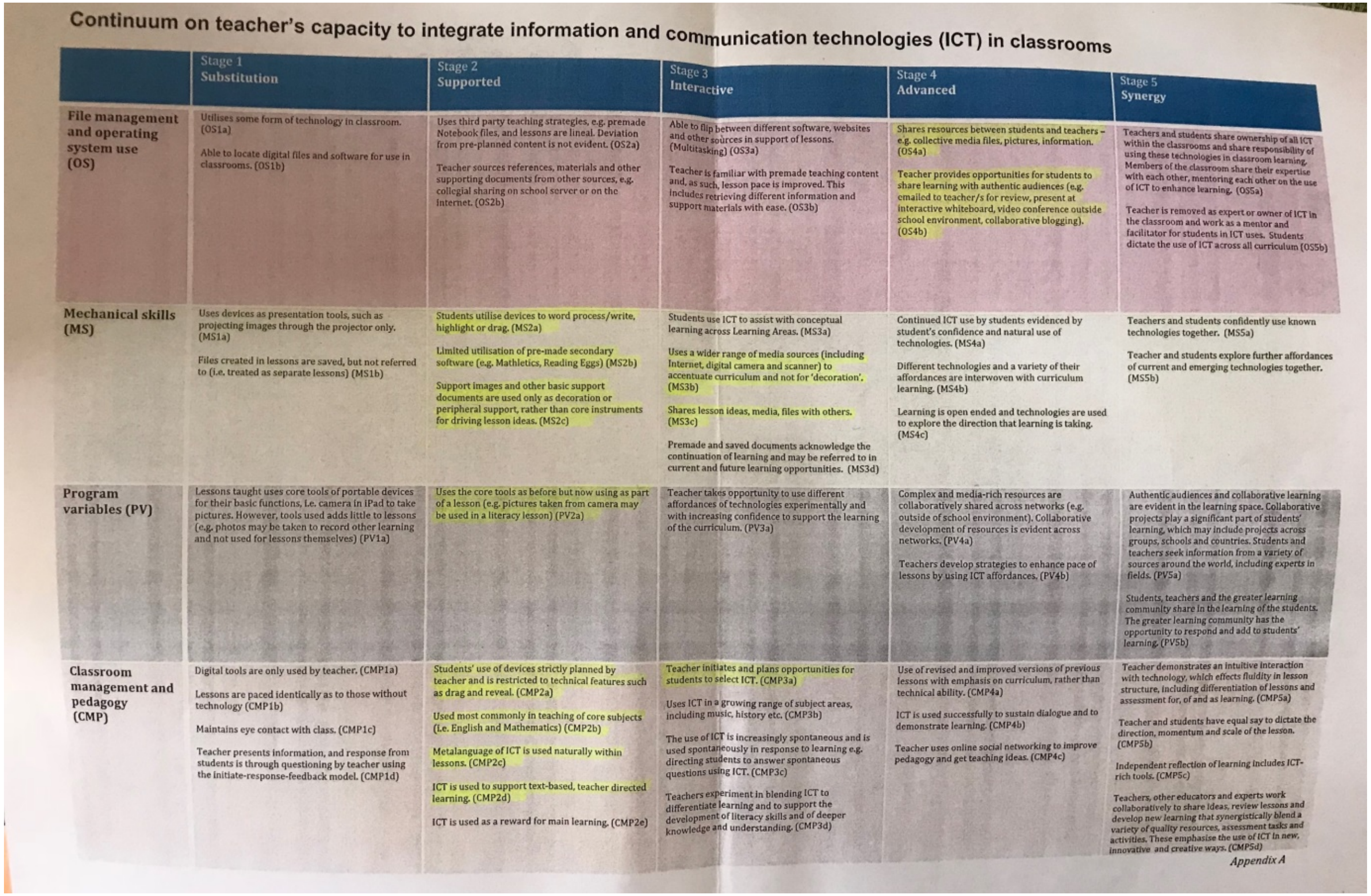
4.4.4 Results of the professional learning

Evidence from Edge Primary School revealed only one category relating to the results of the professional learning, which was the mentee's growth and development.

Mentee growth and development

Both mentors at Edge Primary School did not track Debbie's development on the Recording Tool as intended, but rather highlighted the appropriate access points on the framework. Jennifer did not record Debbie's achievement when she left, and therefore Sarah did not have a beginning level from which to work. To mitigate this problem, Sarah indicated in an email that she and Debbie met to organise their first cycle together. During this meeting, Debbie apprised Sarah of her own progress [September 9, 2017]. Both Jennifer and Sarah marked Debbie's achievement directly on the framework. Figure 4.4.1 shows the highest levels achieved were predominantly in Stage 3, with some achieved at Stage 4 in *File Management and Operating System Use*. Figure 4.4.2 shows all of Stage 4 achieved, with only three access points yet to be achieved in Stage 5. It is assumed that OS5a, PV5b and CMP5d were achieved, despite them being only partially highlighted by Sarah. This assumption was made as the partial highlighting appears to be purposeful.

As with Case 3, the following figures were included so that Debbie's skills against the framework can be seen and compared at the start and at the end of her engagement with the professional learning model. For this purpose, it is important to note the highlighting from each figure in this section. Figure 3.2 provides detailed descriptions of the access points highlighted.

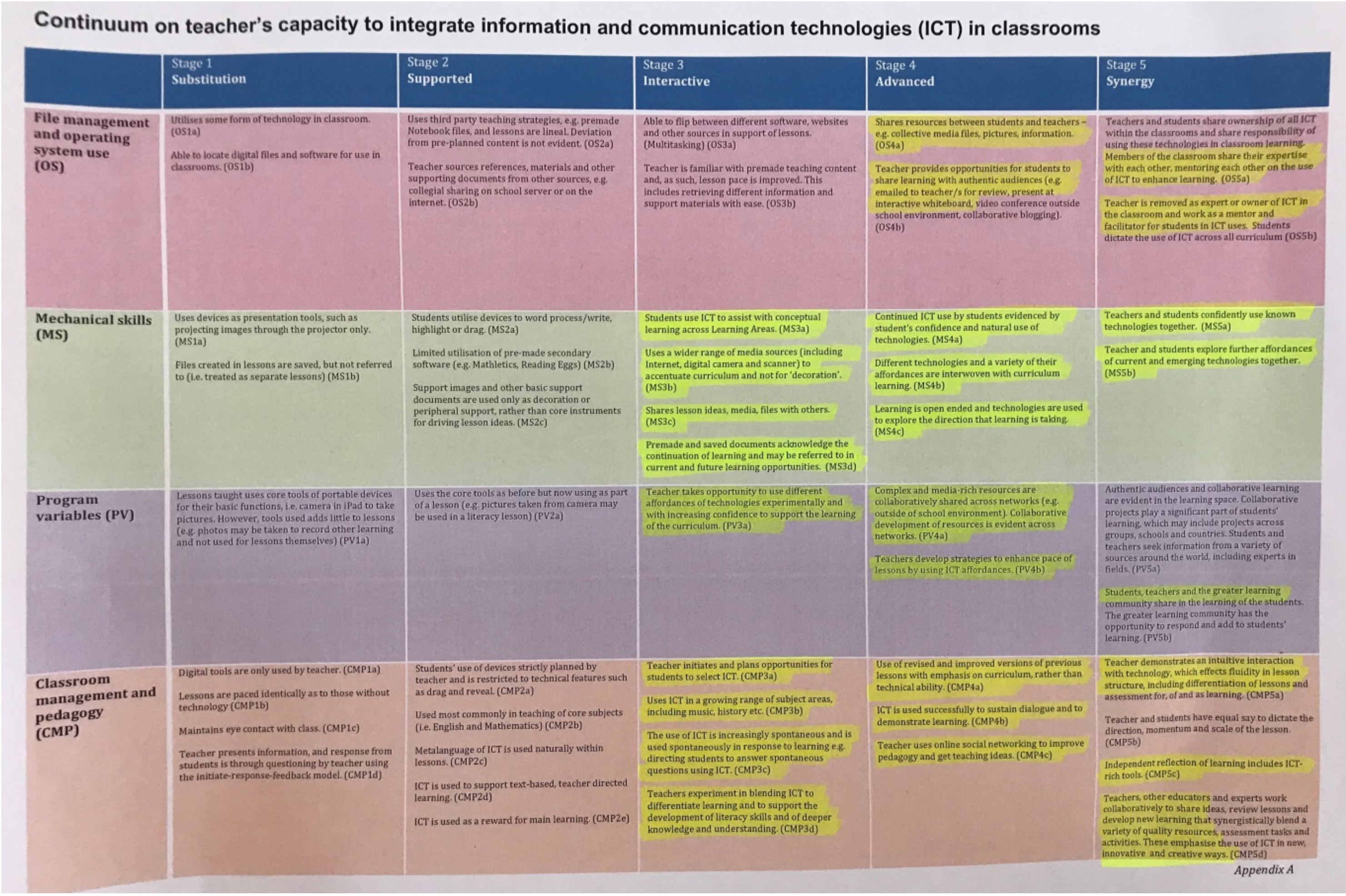


Continuum on teacher's capacity to integrate information and communication technologies (ICT) in classrooms

	Stage 1 Substitution	Stage 2 Supported	Stage 3 Interactive	Stage 4 Advanced	Stage 5 Synergy
File management and operating system use (OS)	Utilises some form of technology in classroom. (OS1a) Able to locate digital files and software for use in classrooms. (OS1b)	Uses third party teaching strategies, e.g. premade Notebook files, and lessons are lineal. Deviation from pre-planned content is not evident. (OS2a) Teacher sources references, materials and other supporting documents from other sources, e.g. collegial sharing on school server or on the Internet. (OS2b)	Able to flip between different software, websites and other sources in support of lessons. (Multitasking) (OS3a) Teacher is familiar with premade teaching content and, as such, lesson pace is improved. This includes retrieving different information and support materials with ease. (OS3b)	Shares resources between students and teachers – e.g. collective media files, pictures, information. (OS4a) Teacher provides opportunities for students to share learning with authentic audiences (e.g. emailed to teacher/s for review, present at interactive whiteboard, video conference outside school environment, collaborative blogging). (OS4b)	Teachers and students share ownership of all ICT within the classrooms and share responsibility of using these technologies in classroom learning. Members of the classroom share their expertise with each other, mentoring each other on the use of ICT to enhance learning. (OS5a) Teacher is removed as expert or owner of ICT in the classroom and work as a mentor and facilitator for students in ICT uses. Students dictate the use of ICT across all curriculum (OS5b)
Mechanical skills (MS)	Uses devices as presentation tools, such as projecting images through the projector only. (MS1a) Files created in lessons are saved, but not referred to (i.e. treated as separate lessons) (MS1b)	Students utilise devices to word process/write, highlight or drag. (MS2a) Limited utilisation of pre-made secondary software (e.g. Mathletics, Reading Eggs) (MS2b) Support images and other basic support documents are used only as decoration or peripheral support, rather than core instruments for driving lesson ideas. (MS2c)	Students use ICT to assist with conceptual learning across Learning Areas. (MS3a) Uses a wider range of media sources (including Internet, digital camera and scanner) to accentuate curriculum and not for 'decoration'. (MS3b) Shares lesson ideas, media, files with others. (MS3c) Premade and saved documents acknowledge the continuation of learning and may be referred to in current and future learning opportunities. (MS3d)	Continued ICT use by students evidenced by student's confidence and natural use of technologies. (MS4a) Different technologies and a variety of their affordances are interwoven with curriculum learning. (MS4b) Learning is open ended and technologies are used to explore the direction that learning is taking. (MS4c)	Teachers and students confidently use known technologies together. (MS5a) Teacher and students explore further affordances of current and emerging technologies together. (MS5b)
Program variables (PV)	Lessons taught uses core tools of portable devices for their basic functions, i.e. camera in iPad to take pictures. However, tools used adds little to lessons (e.g. photos may be taken to record other learning and not used for lessons themselves) (PV1a)	Uses the core tools as before but now using as part of a lesson (e.g. pictures taken from camera may be used in a literacy lesson) (PV2a)	Teacher takes opportunity to use different affordances of technologies experimentally and with increasing confidence to support the learning of the curriculum. (PV3a)	Complex and media-rich resources are collaboratively shared across networks (e.g. outside of school environment). Collaborative development of resources is evident across networks. (PV4a) Teachers develop strategies to enhance pace of lessons by using ICT affordances. (PV4b)	Authentic audiences and collaborative learning are evident in the learning space. Collaborative projects play a significant part of students' learning, which may include projects across groups, schools and countries. Students and teachers seek information from a variety of sources around the world, including experts in fields. (PV5a) Students, teachers and the greater learning community share in the learning of the students. The greater learning community has the opportunity to respond and add to students' learning. (PV5b)
Classroom management and pedagogy (CMP)	Digital tools are only used by teacher. (CMP1a) Lessons are paced identically as to those without technology (CMP1b) Maintains eye contact with class. (CMP1c) Teacher presents information, and response from students is through questioning by teacher using the initiate-response-feedback model. (CMP1d)	Students' use of devices strictly planned by teacher and is restricted to technical features such as drag and reveal. (CMP2a) Used most commonly in teaching of core subjects (i.e. English and Mathematics) (CMP2b) Metalanguage of ICT is used naturally within lessons. (CMP2c) ICT is used to support text-based, teacher directed learning. (CMP2d) ICT is used as a reward for main learning. (CMP2e)	Teacher initiates and plans opportunities for students to select ICT. (CMP3a) Uses ICT in a growing range of subject areas, including music, history etc. (CMP3b) The use of ICT is increasingly spontaneous and is used spontaneously in response to learning e.g. directing students to answer spontaneous questions using ICT. (CMP3c) Teachers experiment in blending ICT to differentiate learning and to support the development of literacy skills and of deeper knowledge and understanding. (CMP3d)	Use of revised and improved versions of previous lessons with emphasis on curriculum, rather than technical ability. (CMP4a) ICT is used successfully to sustain dialogue and to demonstrate learning. (CMP4b) Teacher uses online social networking to improve pedagogy and get teaching ideas. (CMP4c)	Teacher demonstrates an intuitive interaction with technology, which effects fluidity in lesson structure, including differentiation of lessons and assessment for, of and as learning. (CMP5a) Teacher and students have equal say to dictate the direction, momentum and scale of the lesson. (CMP5b) Independent reflection of learning includes ICT-rich tools. (CMP5c) Teachers, other educators and experts work collaboratively to share ideas, review lessons and develop new learning that synergistically blend a variety of quality resources, assessment tasks and activities. These emphasise the use of ICT in new, innovative and creative ways. (CMP5d)

Appendix A

Figure 4.4.1. Debbie's beginning level



Continuum on teacher's capacity to integrate information and communication technologies (ICT) in classrooms

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Appendix A

Figure 4.4.2. Debbie's finishing level

4.4.5 Feedback on the toolkit

The feedback is again grouped in the following four tables. Jennifer provided her response to the survey at the end of her mentoring, while Sarah and Debbie submitted their responses at the end of the case study.

Table 4.4.1

Case 4: Survey responses relating to previous themes

Theme	Question	Jennifer	Sarah	Debbie	Qualitative
Support	My mentor: [Q3.1]				
	was supportive.	N/A	N/A	Strongly agree	*Nil*
	was available for support.	N/A	N/A	Strongly agree	*Nil*
Mentor expertise	My mentor: [Q3.1]				
	is well-versed in integrating ICT in classrooms.	N/A	N/A	Agree	*Nil*
	adequately identified my level of understanding for integrating ICT.	N/A	N/A	Agree	*Nil*
	facilitated my learning progression.	N/A	N/A	Agree	*Nil*
	The process/framework: [Q3.3]				
	has helped me improve my integration of ICT.	Agree	Agree	N/A	*Nil*
	has added to my knowledge of the potential of ICT in education.	Strongly agree	Agree	N/A	*Nil*
	was beneficial to me as the mentor.	Agree	Agree	N/A	*Nil*

Theme	Question	Jennifer	Sarah	Debbie	Qualitative
Educational system and school leadership support	The process/framework:				
	was manageable in terms of time. [Q3.3d]	Strongly agree	Agree	Agree	*Nil*
	Were you afforded more time to observe and meet with your mentee? [Q3.5]	No	No	N/A	More time to meet and discuss progress and to plan would have been more beneficial but it was still [an] effective process simply using my RFF and out of school hours time. [Jennifer] It would have been helpful. Our whole school strategic directions didn't involve ICT so it was hard to make any extra release time available and accountable. [Sarah]
Mentee growth and development	My mentee was: [Q3.1]				
	eager to shift and demonstrate growth according to the framework/process.	Agree	Agree	N/A	*Nil*
	receptive to my suggestions.	Agree	Agree	N/A	*Nil*
	an active participant in the partnership.	Agree	Agree	N/A	*Nil*
	The process/framework: [Q3.3]				
	has helped me improve my integration of ICT.	N/A	N/A	Strongly agree	*Nil*

Theme	Question	Jennifer	Sarah	Debbie	Qualitative
	has helped change my teaching pedagogies.	N/A	N/A	Agree	*Nil*
	has added to my knowledge of the potential of ICT in education.	N/A	NA	Strongly agree	*Nil*
Students' reactions	After the study: [Q3.5]				
	my students are more engaged due to my ability of ICT integration.	N/A	N/A	Strongly agree	*Nil*
	my students are attaining more learning outcomes due to my lessons being more enriched by ICT.	N/A	N/A	Agree	*Nil*

Table 4.4.2

Case 4: Participant intentions after the study

Question	Jennifer	Sarah	Debbie
After the study: [Q3.7 (mentor) and Q3.5 (mentee)]			
I will continue to work with my mentee/mentor to improve their level of ICT integration.	Disagree	Agree	Strongly agree
I will continue to use the framework.	Strongly agree	Agree	Strongly agree
I am happy to mentor other colleagues. (Mentor)	Strongly agree	Disagree	N/A
I feel confident in mentoring other teachers in integrating at least some aspects of ICT. (Mentee)	N/A	N/A	Agree
Other comments: I am unable to continue to mentor my mentee as I have left the school. If I was still there, I would have definitely continued with my mentee and others to [I] work with. [Jennifer] I probably wouldn't continue as a mentor as ICT is not my own strong point. I took on this project as a favour after the original mentor left the school. [Sarah]			

Table 4.4.3

Case 4: Participant feedback regarding the process and framework

Question	Jennifer	Sarah	Debbie
My mentee and their skills were easily identified on the framework. [Q3.1b]	Strongly agree	Agree	N/A
The process and framework: [Q3.3]			
gave me the tools to provide practical advice to my mentee.	Strongly agree	Agree	N/A
was easy to follow.	Agree	Agree	N/A
made it easier to mentor, given the explicit instructions and instruments.	Strongly agree	Agree	N/A
has useful instruments important to the process.	Agree	Agree	Agree
is cost effective.	Strongly agree	Agree	Strongly agree
has been a greater benefit than a one-off course.	N/A	N/A	Agree
was easy to follow.	Agree	Agree	Agree
Other comments: Even though I participated for only a limited time, I found this process very beneficial for establishing and maintaining a mentor/mentee relationship. The tool was very user friendly and was a great scaffold for reflecting on practice and developing ICT skills in both the mentor and mentee. I look forward to using it again. [Jennifer]			

Table 4.4.4

Case 4: Consolidated feedback relating to the framework

Framework	▪ Easy to track progress ▪ Easy to identify next steps

4.4.6 Summary of Edge Primary School's case study

Edge Primary School was the final school that was able to engage with the professional learning model. Debbie had two mentors, Jennifer and Sarah, Jennifer moved interstate partway through the case study. While both mentors appeared to have established relationships with Debbie, Jennifer reported that she felt the process helped her and Debbie to establish a mentor-mentee relationship.

Despite the difference in the mentor-mentee relationships, which will be examined in more depth next chapter, the mentors engaged in some similar mentoring strategies that resulted in Debbie's growth in skills and confidence when integrating technologies. It appears that Debbie's confidence was not hindered by Sarah's lack of confidence in her own ability to integrate interactive technologies. This lack of confidence resulted in the adoption of a 'learn together' model between Sarah and Debbie, which differed from the mentoring model which Jennifer engaged. This case study also revealed a need for the mentor to engage in their own development activities.

Case 5: Tableland Primary School

Case 5 was from the medium-sized Tableland Primary School and would have presented a unique context, where one mentor was mentoring two mentees. As summarised in Table 3.2, Stuart was a Year 5 and 6 teacher, who adopted the role of mentor for Ronda, who was teaching Years 4 and 5 students, and Esther, who was teaching Years 1 and 2 students. The participants, during the pre-study meeting, expressed their readiness to participate in the study and to engage with the professional learning model. However, for the reasons described below, this case study did not proceed. Stuart, on behalf of the school, consented to the use of any data gathered, such as emails and anecdotal field notes.

The email interactions with the participants provided insight into reasons that they were unable to engage with the study. Initially through an email [August 19, 2017], Esther expressed her need to withdraw from the study as she needed to catch up with her teaching responsibilities after a prolonged illness. Several months after this, Stuart and Ronda also withdrew. Stuart's email below shows the combination of personal and professional reasons that led to the withdrawal. The latter may be attributed to 'Factors contributing to the professional learning: Educational system and school leadership support'.

> After weeks of pulling out my hair over this, I have had a conversation with [Principal] and Ronda and we all agree it is of best interest to withdraw from the study.
>
> Unfortunately, even the best plans go pear shaped and with Ronda's professional learning requirements and commitments as well as needing to leave school to be with family in the afternoons, it has made it incredibly difficult to complete. I was also going to complete my observations in my release which unfortunately is often spent in my room

> due to my students' high support needs and supporting the RFF teacher. So even though we meant to complete it every week, with one of my students, I am not in the position to leave him in the mornings. I highly doubt the school would have had the resources to release me at this point in time to complete the study.
>
> My deepest apologies, particularly as I believe the matrix [framework] could be incredibly useful for teachers' professional learning which is why I was so keen in the first place.
>
> [November 5, 2017]

4.5.1 Summary of Tableland Primary School's case study

Tableland Primary School was anticipated to be the fifth and final case study to engage with the professional learning model. However, within weeks of the initial pre-study meeting, the first mentee, Esther, withdrew due to extended illness. Ronda and Stuart both withdrew from the study due to Stuart's inability to observe Ronda's lessons. This case study presents the realities of competing demands in schools, revealing issues relating to the teachers' responsibilities, as well as impacts of personal circumstances on professional priorities in Esther's case. It is important to recognise such realities when attempting to implement professional learning programs in schools and, while providing little detail to discuss, it remains a significant finding of this study.

4.6 Summary of the case studies

This chapter has presented the findings from the five cases that were studied throughout 2017. Major themes identified from the case studies were considered under the broad categories of: mentor-mentee relationships; factors that influenced the mentees' integration of interactive technology; factors contributing to the implementation of professional learning; the impact of the professional learning; and feedback on the toolkit. The findings from each case were presented within each unique context's own characteristics and constraints. The following chapter will discuss the findings, through a closer examination of how the categories and themes were manifested across the cases with respect to the research questions.

CHAPTER 5
DISCUSSING THE FINDINGS

Chapter 4 categorised the findings resulting from the implementation of the professional learning model and the framework in each of the five unique primary school contexts. Aligning with the critical constructivist and interpretivist analysis approaches adopted in this study, as described in section 3.1, Chapter 4 described the data through the lens of the participants' interpretations in the form of their reflections, which were then grouped by the researcher's analyses. This chapter continues from this process by reporting on the second and third layers of interpretations, where the researcher interprets the findings across the case studies, and considers the findings with those found in the wider body of research relating to technology integration and professional learning. Variations occurring between the cases and with existing research confirm the assumption that there is no single source of 'truth', which is consistent with a pragmatist ontological theory. These variations provide nuances to a particular theme, allowing the audience to develop understanding of these variations within the participants' and their own contexts, aligning with a critical constructivist stance.

Determined through the analysis process described in Table 3.4, Chapter 4 grouped the findings within each case under four broad categories, which were:

- mentor-mentee relationship
- factors that influenced the mentees' integration of interactive technologies
- factors contributing to the study's model of professional learning
- the impact of the professional learning model and feedback on the toolkit.

These categories and those themes that exist under them are now organised in this chapter under the three research questions that this study was designed to address, which are:

1. What factors influence the way primary teachers integrate interactive technologies in their learning spaces?
2. What features of a mentoring model can facilitate building primary teachers' capacity for integrating interactive technologies?
3. In what ways can a structured technology integration framework facilitate professional learning?

While most themes will exist under a single research question, there are some, such as 'Educational system and school leadership support', that will appear under multiple research questions. This is so that the themes can be organised to appropriately address the questions. A comprehensive list of the categories and themes can be found at Appendix H. A comparative examination of the commonalities and differences in the way certain themes manifested in the cases. Features that are relevant to the refinement of the professional learning model, the framework and the supporting templates, or the toolkit, are discussed further in Chapter 6 and presented in their final form at Appendix C.

Research Question 1
What factors influence the way primary teachers integrate interactive technologies in their learning spaces?

In response to the first research question, the findings under the category of 'the factors that influenced the mentees' integration of interactive technologies', as seen in Chapter 4, will be examined in this section. These findings will be examined against those factors identified in the literature review in Chapter 2, and will be organised under this question as:

- access to technology
- educational system and school leadership
- teacher expertise, attitudes and beliefs
- students' skills and attitudes
- curriculum delivery.

Also, by responding to this research question, this study contributes to the wider body of research in technology integration by revealing those factors that are specific to the primary school context.

5.1.1 Access to technology

Section 2.1.2 showed that previous studies could not agree on the level of impact that access to quality and reliable technology has on teachers' ability to integrate technologies. While this study found that access to technology remains an issue for teachers trying to integrate it, the evidence also suggests that 'access' needed to be examined further.

Recent studies in both primary and secondary school contexts (e.g., Diogo et al., 2018; Watkins et al., 2015) have reported an increased access to technology, and that students have more equalised access at school and at home. Despite these findings, the availability of technology, a sub-factor to technology access, remained an issue for Hunter Primary School, as seen in section 4.2.2. During the first two cycles of the professional learning model at Hunter Primary School, Angela was unable to access the necessary technology. During these cycles, references were made by both the mentor and the mentee to the Kindergarten classes getting a dedicated set of iPads. The discussions outlined how the imminent arrival of these iPads would overcome issues of access and availability for Angela and her students. There were certain affordances of her learning environment's technologies that Angela wanted her students to access, such as the interactive learning that certain iPad applications could provide, consistent with one of the benefits of technology in education (Hazari et al., 2009). It is assumed that these iPads were procured, as this issue was not mentioned after the second cycle. Hunter Primary School provided evidence that this factor ceased to be limiting as the iPads became more available. This change in access and the consequent removal of the barrier support similar findings from other studies in K–12 schools (e.g., Albion et al. 2015; Liu et al. 2017), which indicate that access to quality technology in learning spaces is necessary for effective integration.

The reliability of technology, another sub-factor, was revealed as an issue at both Ridge and Edge Primary Schools, as it was in the *Riverina Access Program* evaluation, which was conducted in a number of secondary schools (Harriman et al., 2016). In the evaluation, technology reliability caused issues of connectivity, as students and teachers could not connect to the remote lessons. The issues of reliability in the evaluation tended to be related to the maintenance of the video conferencing devices and to the inconsistent quality of devices within and across the schools. In this study, however, the definition of reliability was broader and was different at each school. At Ridge Primary School, as seen in section 4.1.2, technology reliability issues manifested in terms of the usability of the school's laptops. Sally frequently mentioned that the laptops did not function or were unable to link to the school's infrastructure. This evidence was further reinforced by the observed behaviour of Allan during the mid-study school visit, who often remediated laptop problems.

Edge Primary School did not have reliability issues with their technology itself, but rather with the protocols surrounding its use. The evidence, as demonstrated in section 4.4.2, showed that Debbie could not reliably assume that their iPads could be used. As the iPads were shared across the school, they could arrive at the classroom just prior to the lesson. Debbie found that the iPads were sometimes not ready for use, as some of them were not suitably charged.

In both cases, the schools had problems with infrastructure reliability. As mentioned, Sally's students had difficulties linking with the school network. The findings suggested that the issue was caused by the unreliability of both the laptops and the school's infrastructure. While not as prevalent as at Ridge Primary School, Debbie found similar issues when attempting to connect to the internet with her school's iPads.

Despite these differences, both schools found that the individual reliability problems impacted on their ability to successfully integrate the technologies into the teaching and learning activities, in line with studies such as that by McKnight et al. (2016). In different circumstances, the evidence showed that the teachers had to make decisions, sometimes on the spot, to change intended activities or pedagogical direction (as seen in sections 4.2.2 and 4.3.2). These changes, and the realisation that the technologies could not be reliably used, also impacted on the flow of the lessons. An example of this impact can be seen in the excerpt below, where connectivity issues caused Debbie to stop her lesson for several minutes to remedy the problems.

Debbie: Apart from the iPads not connecting properly, I …

Sarah: And that only took three minutes, maybe? Three, four minutes.

[October 12, 2017]

River Primary School, as a BYOD school, did not identify any limitations in regards to technology availability and reliability. Each student brought their own device to school, had reliable access to the school's infrastructure and, if their own device failed, had contingent devices available in the form of class iPads. Access to technology was somewhat different at River Primary School. In this case, compared with other case study schools, problems with access to technology were found when accessing applications for teaching and learning activities. This particular limitation manifested in two different ways. Firstly, Kelly raised concerns relating to child protection when engaging with and producing online content. Andrew and Kelly discussed the potential risks associated with the end-of-video montage in *YouTube* (section 4.3.3), where inappropriate content might be seen by the students. A second limiting factor was the differing levels of functionality within the same applications across the varying devices (section 4.3.2). Kelly found that students were able to do certain activities on a particular device, while other students could not do the same activity on another type of device. This reveals another complexity of the affordances of technologies, where the affordances of one technology (i.e. the students' devices) were impacting on the affordances of another (i.e. the software application). This complexity adds to the difficulty for teachers to be aware of all the affordances in every individual technology used for education, such as explained by Haines (2015). Application limitations were also found at Hunter and Edge Primary Schools. Angela found certain applications did not work as she anticipated. In this case, Rob praised Angela's ability to smoothly change learning activities in response to this limitation (section 4.2.2). Similarly, Debbie found that *Mathletics* did not function as intended on the school's iPads, or that some of the iPads were not able to connect to *Google Earth* and *Google Maps*. To accommodate for the connectivity problems, she had to regroup students so that they could access the applications (section 4.4.2). There was no reference to Kelly altering the learning activity during the lesson to make allowances for the limitations of the devices or the applications. The fact that Kelly did not deviate her learning activities to accommodate for these limitations may suggest that her TPK, as seen in the TPACK Framework (Koehler, 2017; Mishra & Koehler, 2006), was not as developed as Angela's and Debbie's TPK, as indicated by these teachers' results on the framework (Figures 4.2.3, 4.3.3, 4.4.2). As seen in the relevant sections in Chapter 4, these access limitations impacted on the lesson flow, the intended learning activities and the pedagogical approaches of these teachers. The consequent changes to the lessons, therefore, not only affected the teachers' ability to integrate the appropriate technologies for the planned lesson but also shaped the students' overall learning experiences.

Despite impacts of the limitations that have been mentioned, the mentoring process provided means to mitigate the limitations. Allan from Ridge Primary School recommended that a USB drive could be used so that students could access the necessary files (section 4.1.3). Rob from Hunter Primary School, prior to the procurement of more iPads, provided Angela with strategies to use the available technologies (section 4.2.3). River Primary School participants discussed strategies to avoid access to inappropriate content and to intentionally group students to overcome software limitations on different devices (section 4.3.3). Angela and Debbie overcame the limitations in their particular contexts by using other applications (section 4.2.2) and through deliberate student grouping (section 4.4.2). Notably, the mentors at Edge Primary School did not offer any solutions to mitigate their infrastructural issues. It appears that the casual way in which the teachers mentioned these issues suggested that the teachers at this primary school have 'accepted' this problem as part of their school's operations.

The ability of the mentors at Ridge, Hunter and River Primary Schools to provide supportive strategies to mitigate these access issues suggests that mastery in the use and integration of the technologies is more important than having more or better access to them, aligning with studies such as Newhouse (2014), conducted in secondary schools, and Ertmer and Ottenbreit-Leftwich (2013), conducted in K–12 contexts. These studies provided earlier evidence that access to technologies is less likely to impact on teachers' ability to integrate technologies than their skills in identifying and using the affordances provided by their available technologies. Similarly, it was assumed that the mentors were more skilled in technology integration than the mentees. Consistent with Gibson (1977) and Haines (2015), this level of skill would allow the mentors to perceive and take advantage of the available technologies' affordances, as well as overcoming their limitations. While these studies, as well as the evidence from the study reported in this thesis, supported the need for teachers' mastery in integrating technologies, the evidence from this study suggest that the factor concerning the impact of access issues on the participants should not be ignored.

5.1.2 Educational system and school leadership support

Chapter 2 revealed that educational system and school leadership support is especially pertinent when budgeting to buy technologies, and when defining policies, practices and culture of technology usage (Ertmer & Ottenbreit, 2013; Hardy et al., 2017). This appeared to be as important for the participants in this study. The decisions to upgrade and improve infrastructure reliability, as needed by Edge Primary School, and access to reliable technologies, as required by Ridge and Hunter Primary Schools, would be made by the school leadership. After the school leadership decided to procure iPads for the Kindergarten classes, Angela no longer referred to access as an issue.

More starkly indicated by the evidence was the impact of leadership on the culture of technology integration in a school. This evidence aligns with findings from studies by Aubusson et al. (2015), and Whitworth and Chiu (2015). These studies emphasised the need for the leadership to foster a school culture that encourages changes to teacher efficacy through discussion and collective learning. Such school culture would influence teachers' perceptions about the value of technology integration. This impact can be strongly seen at Hunter Primary School. Angela felt pressure from other, more experienced, Kindergarten teachers at her school, shown in section 4.2.3 and Table 4.2.2. She found that the other teachers were less confident when integrating technologies for teaching and learning. As a result, activities planned for all Kindergarten students did not provide her with the opportunities to use available technologies for teaching and learning. Angela felt that it was difficult for her to fully explore the affordances of her technologies in teaching and learning, due to the pressure she felt from the other teachers to reduce the use of technology for the Kindergarten classes. Conversely, Rob was supported by other members of the IT committee at the school, who shared the same commitment for building other teachers' capacity when integrating technology and for building, in the school, a culture of effective technology use (section 3.3.3). Another example of leadership support is the BYOD policy at River Primary School, which facilitated and encouraged the use of technology in Stage 3 (Years 5 and 6) classes. This, as seen in section 5.1.1, removed problems with availability and reliability of technology, and allowed Kelly to more easily integrate technologies into her teaching and learning plans. These examples, particularly in the conflicting levels of support from different groups in Hunter Primary School, suggest a need for a whole school approach, where a common goal for effective integration of technology is enacted by the school leadership. This need for a clear direction and support from school leadership can also be found in other studies (e.g. Eiklemann et al., 2017; Levin & Shrum, 2014).

5.1.3 Teacher expertise, attitudes and belief

The aim of the study was primarily to examine teacher growth when integrating technology, and factors influencing this growth. For this reason, the methodology was not designed to specifically explore the impact of teachers' expertise, attitudes and beliefs on their integrative abilities. However, the data did present some evidence for these skills and values, and may be used alongside the assumptions made initially in the research design. Firstly, drawing from studies discussed in the literature review, such as King (2014), Kraft et al. (2016) and Padmavathi (2017), an assumption was made that an increase of expertise, or a change to attitudes and beliefs relating to technology integration, would lead to better or increased integration into teaching and learning. It was also assumed that the mentees had at least some need for, or placed value on, the integration of technology, as all the participants in this study were positive volunteers, as opposed to times when school leaders might mandate professional learning. The mentees' positive dispositions towards technology integration in teaching and learning would therefore, presumably, facilitate the mentoring in this study, as the mentors would not need to overcome any resistance from the mentees.

It was expected that the mentees would demonstrate varying skill sets and values, not only in the use and integration of technology into teaching and learning, but also specifically in their technological and pedagogical skills. For this reason, as explained in section 3.4.1, the technology framework used in this study showed TK and PK skills towards the beginning of the framework and scaffolded progressively towards the end of the framework, which describes skills demonstrating TPK. Technological-Pedagogical Knowledge (TPK), from the TPACK Framework (Koehler 2017; Mishra & Koehler, 2006), was particularly pertinent to this study, given that the integration of technology is the use of technologies to enhance the pedagogy. In rare occurrences, Angela and Kelly both demonstrated Technological-Pedagogical-Content Knowledge (TPACK), as seen in sections 4.2.2 and 4.3.2 respectively, where they used their technological and pedagogical skills to deliver content. As mentioned in section 3.2.1, the skills and behaviours in the framework do not reflect an expectation that teachers will demonstrate TPACK, but rather only TPK. This was to acknowledge that each context would be delivering different content and curriculum, such as seen in section 5.1.5. However, it was not unexpected to find Angela and Kelly providing evidence for their TPACK, when all teachers should, without technology, be evidencing expert PCK (Shulman, 1986). The mentees' varying skills, demonstrated at different times during the mentoring cycles (sections 4.1.2, 4.2.2, 4.3.2 and 4.4.2), provided evidence of the mentees' ability to integrate technology. This ability, understandably, and each teacher's PCK and experience impact directly on the teachers' ability to perceive and take advantage of technology's affordances for education (Gibson, 1977, Haine, 2015), as well as laying a foundation on which the mentors could build. Further elaboration of these aspects is presented in section 5.3.1.

The findings from Hunter Primary School provided evidence that teachers' attitudes may affect their ability to integrate technologies. In an email, Rob explained that Angela was less willing to 'perform' in front of other teachers (section 4.2.2). She felt forced to select certain technologies when Rob was observing the lessons, making technology use during those observations less organic. As explained by Aubusson et al.'s (2015) hypothesis, teachers may find lesson observations daunting and judgemental. The way which Angela was using technology in a contrived way during the lesson observations showed there was, possibly, still an element of Angela feeling judged during those observations. While, as stated in section 3.5.1, it was emphasised that these lesson observations were prescribed and undertaken for the purpose of growth, it appears that the stigma around lesson observations remained. It might be worth considering whether a longer exposure, beyond the six weeks of this study, might mitigate this stigma, as the process might become more normalised.

5.1.4 Students' skills and attitudes

The way in which students' skills and attitudes impacted on the mentees' ability to integrate technology differed across the cases. As the study operated within primary school contexts, where teachers normally teach students of diverse abilities from Foundation to Year 6, it is necessary to consider how the diversity of students' skills can impact on teachers' ability to integrate technology. Hunter Primary School provided the most evidence about the impact of this factor. At this school, both Rob and Angela frequently raised concerns that the developmental stages of the Foundation or Kindergarten students would impede Angela's ability to demonstrate her integration skills at the higher end of the framework (section 4.2.2). This raises two issues to note. Firstly, while the results of the professional learning, discussed later in this chapter, revealed that Angela was able to demonstrate these higher skills, this concern remained. This suggests that the preconceived perceptions of students' skills impacted on Rob and Angela's confidence in Angela's ability to learn and demonstrate these higher-level skills. This issue is particularly stark when other cases, where the other mentees were teaching students of higher scholastic years and with, presumably, greater technological and scholastic abilities, did not reveal the same concern. Second, the fact that Angela was able to achieve the higher access points on the framework, despite Rob and Angela's concerns, suggests that there may be certain complexities relating to King's (2014) assertion that a teacher's positive attitudes towards their professional learning would more likely lead to their increased capacity.

Despite this concern, students' behaviours and actions resulting from the mentees' successful integration of technology elicited positive responses from the participants. In all cases, participants expressed, through their words and tone from the audio recordings, that they were positively surprised at some of the students' reactions to the explicit and integrated learning. This positive reaction is exemplified by the statement below, where Kelly was surprised that some of her less capable students demonstrated unexpected independence.

> I've felt like I've had to do almost nothing to help them. And they weren't even groups of kids you'd think of as really capable …
>
> [August, 2017]

Due to the positive nature of these responses, it can be confidently assumed that students' responses to the mentees' integration of technology would have a positive impact on the value the mentees placed on the integration of technology and the professional learning model in this study. This premise is further supported by Guskey (2002), who suggested in his model of teacher change, that a change in student learning outcomes impacts on teachers' beliefs and attitudes. Common across all the cases were positive reactions to students' independence, their willingness to support their peers, and their natural or existing abilities. These behaviours could be seen at the upper end of primary school in Stage 3 students, as well as younger students in Kindergarten. For example, Angela's Kindergarten students were happy to access the expertise of their peers and support each other rather than be reliant on the teacher (section 4.2.2). At the other end of the primary school spectrum, Kelly expressed surprise at one of her Year 5 students, who showed increased independence during learning, as well as seeing the willingness of her students to support each other and access each other's expertise (sections 4.3.4 and 4.3.2). Therefore, the positive reactions from the teachers to the change in their students’ learning behaviours suggest a development of more positive attitudes towards ICT integration in the teachers themselves.

Other aspects of changed student behaviours and reactions can be seen in students’ achievement and participation in the integrated teaching and learning. The mentees expressed contrasting responses regarding the relationship between student outcomes and increased teacher skills in technology integration, as seen in Table 5.1. Several possible reasons for the mentees’ varying responses emerged. Firstly, while there does not appear to be any conclusive evidence that technology use directly improves student outcomes (e.g. Hattie, 2013a; OECD, 2015), effective technology integration into traditional teaching is said to transform teaching and learning to more student-centric approaches, such as seen under the technologies’ beneficial affordances listed in section 2.1.1. Angela and Debbie showed the greatest amount of growth (as will be discussed further in section 5.3.1) and they evidenced the greatest level of achievement in Stage 5 of the framework by the end of the study. As previously mentioned in section 3.4.1, student-centric behaviours and skills are phased in as a teacher progresses towards the higher stages of the framework. Therefore, it may be that only students from Angela’s and Debbie’s classes had increased access to the mentioned beneficial affordances. Secondly, it should be noted that both Sally and Kelly were the most critical of the professional learning model and the supporting templates, and that Sally was the least able to fully engage with the intended process, as seen in Table 3.3. Also, the difference in the duration of engagement the participants had with the study (Table 3.3) may mean that teachers have not had the time to fully assess student growth.

Table 5.1

Comparison of mentees' response regarding student learning outcomes

	Sally	Angela	Kelly	Debbie
After the study, my students are attaining more learning outcomes due to my lessons being more enriched by ICT.	Disagree	Agree	Disagree	Agree

While the mentees expressed different perceptions about the impact of more integrative learning on their students' achievement, all mentees agreed that students' participation in their learning was improved as a result of their teachers' changed ability in integrating ICT, as seen in Table 5.2. Further evidence of this change can be found in the transcripts, where in every case, except Edge Primary School, improved student engagement was reported (sections 4.1.4, 4.2.4 and 4.3.4).

Table 5.2

Comparison of mentees' response regarding student engagement

	Sally	Angela	Kelly	Debbie
After the study, my students are more engaged due to my ability of ICT integration.	Agree	Agree	Agree	Strongly agree

Further evidence of positive changes to students' responses to their learning could be seen in different contexts. For example, Angela found that her students were more confident in demonstrating their skills during lessons enriched with ICT (section 4.2.4), while Kelly saw increased student enthusiasm for learning activities (section 4.3.4). Andrew from River Primary School saw the students teaching him new skills, indicating their changing abilities also impacted on the teacher's learning.

The positive reactions from the teachers to their students', sometimes unexpected, responses to the lessons specifically integrated with technologies would most likely have impacted on the teachers' attitudes towards ICT integration, in accord with Guskey's (2002) model of teacher change. Howard (2013) reported that the value teachers place on technology integration, and their attitude towards it, directly affect their ability and willingness to demonstrate integrative behaviours. The mentioned possible change to attitudes, in alignment with Howard's (2013) report, may have contributed to the results of the professional learning and the findings here suggest it could be a strong contributor to the mentees' willingness and ability to integrate technology into the curriculum.

5.1.5 Curriculum delivery

The literature review showed that transference, where new skills can be applied in a variety of contexts, is an important aspect for any professional learning (AITSL, 2014). The study reported in this thesis revealed that skills learnt from the professional learning model could be applied in a variety of contexts and purposes, such as in the delivery of the curriculum from different learning areas. In one example, Edge Primary School began planning the integration of technologies for a Geography unit of work, immediately after a lesson observation relating to literacy and English groups that were enriched by ICT. The transcripts and the notes from the mid-study lesson observations showed that the mentees used a variety of learning areas, as reported in the introduction to each case study in Chapter 4. The learning areas taught by the different mentees during the study have been collated in Table 5.3.

Table 5.3

Curricula delivered by the mentee participants

Ridge PS	Hunter PS	River PS	Edge PS
Science and Technology	English Mathematics	History Geography	Mathematics English Geography

The study did not deliberately explore the relationship between the integration of technology with different areas of the curriculum. There is some evidence that suggests that curriculum topics did not limit the teachers' technological-pedagogical practices, as revealed by the fact that three out of the four case studies taught from two different curricula. However, to confirm this assumption, further studies in this area would be warranted.

Research Question 2
What features of a mentoring model can facilitate building primary teachers' capacity for integrating interactive technologies?

The literature review in Chapter 2 revealed a number of factors that contribute to successful mentoring. These were:

- transference (AITSL, 2014), as discussed previously in section 5.1.5
- a collaborative mentoring relationship (Hardy et al., 2017)
- having a mentor who is an expert in both content knowledge and mentoring (Kraft et al., 2016)
- mentor and mentee motivation in engaging with the professional learning (Maor & McConney, 2015; Orlando, 2014)
- mentees' positive attitudes towards the professional learning (Orlando, 2014)
- contextually-based support, where the professional learning is tailored to the mentee's needs (Burke et al., 2015; Nolan et al., 2013)
- a reflective process, which allows the mentee to reflect on current and new practices (Hudson & Hudson, 2016; Nolan et al., 2013).

While attention to many of these features were intrinsically designed and built into the professional learning approach in this study, the findings from the five case studies revealed the importance of these features, as well as certain subtleties relating to them. Drawing primarily from the findings that were categorised in Chapter 4 as 'mentor-mentee relationship' and 'factors contributing to the study's model of professional learning', the following sections will discuss the subtleties that existed within the mentor-mentee relationships, the selection of the 'right' mentor, mentee attitudes towards and interaction with the professional learning, and educational system and school leadership support.

5.2.1 Mentor-mentee relationships

The mentoring structure of this study was designed to be intrinsically collaborative and relational (as explained in section 3.2.1). Firstly, the design of the study ensured that the mentoring partners came from the same school. Therefore, in line with studies reporting the benefits of contextually-based professional learning (Burke et al., 2015; Nolan et al., 2013), participants shared contextual knowledge with their mentoring counterparts. Secondly, the pre-study meetings, as described in section 3.5.1, emphasised the collaborative nature of the mentoring structure, as well as reinforcing the need for an even balance of power between the mentor and the mentee. This balance of power is essential for any successful mentoring, as argued by Hudson and Hudson (2016), and Kemmis et al. (2014). Despite these in-built constructs in the mentoring process, there was a variety of relationships evident across the cases, in terms of type and strength.

At Ridge Primary School, there did not appear to be, initially, any notable relationship between Allan and Sally. The findings showed that the mentoring relationship between these two participants was relatively weak at the beginning of their case study. This lack of a relationship at the beginning resulted in conversations that were less interactive (section 4.1.3). As these participants entered into the third cycle, the relationship appeared to be much stronger, and therefore resulted in more natural interactions between the mentor and the mentee. It seems reasonable to assume that should this case have continued beyond the third cycle, Sally and Allan might have been able to reveal a stronger mentor-mentee relationship, where the interactions would be increasingly natural and show a more even balance of power between Allan and Sally.

The case study at Edge Primary School had two different mentor-mentee relationships due to a change in mentors. The first relationship between Jennifer and Debbie did not reveal any form of existing mentoring relationship prior to the study. In fact, Jennifer mentioned, in her survey response, that this research study established the mentor-mentee relationship between her and Debbie (Table 4.4.3). Even though the relationship between Jennifer and Debbie was new, this did not appear to affect the conversations between these two participants. While predominantly mentor-led, the conversations were generally interactive and collaborative. The participants reflected together on Debbie's teaching and discussed her growth collaboratively. The other mentoring partnership at this school, between Sarah and Debbie, revealed an established mentoring relationship. Sarah, as the Stage 1, or Years 1 and 2, literacy coordinator at the school, had previously mentored and supported Debbie in literacy teaching and learning for her Year 2 class. Despite these differences in relationships, the professional learning process at Edge Primary School appeared to be relatively strong and engaging under both mentors. This was contrary to the findings of Mansfield and Thompson (2017), who claimed that an established professional trust facilitates deeper learning engagement. The strength of the relationship between Jennifer and Debbie may have been built on Jennifer's ability to mentor and the existing collegial relationship that was evident during the pre-study meeting. This existing collegial relationship might have influenced the professional trust mentioned as necessary by Mansfield and Thompson (2017).

In most cases, this factor of relationship strength did not appear to have had an impact on the effectiveness of the other mentoring partnerships. These partnerships were established on existing mentoring or supervisory relationships. Rob and Angela had an existing mentoring relationship, where Rob had previously served as Angela's supervising teacher for one of her university practicums. This existing relationship allowed Rob to have a good understanding of Angela's abilities at the beginning of the case study and formed a foundation on which the mentor-mentee relationship could build. Andrew and Kelly had a similar established relationship, where Andrew had been serving as Kelly's supervisor. When Andrew left the school, he was replaced by David, who did not have an existing relationship with Kelly. However, David also replaced Andrew in the supervisory role, which served to establish a supervisory relationship between Kelly and David. Hay Group (2013) explained that a mentor would be responsible for establishing and maintaining the participants' confidence in the mentoring relationship. While it did not appear that this impacted on the effectiveness of the professional learning, the change in mentors and the duration of when David assumed the role of Kelly's supervisor and mentor during this study, appeared to have impacted on Kelly's attitudes towards and beliefs about this learning. It may be that the limited time David was mentoring Kelly reduced her confidence in the learning process. Kelly was highly critical of the professional learning model, which will be discussed in detail in relation to Research Question 3.

As discussed, while the need for an even balance of power was emphasised during the pre-study meeting (section 3.5.1), achieving such a balance was more obviously seen at Hunter and River Primary Schools. The mentors at these schools worked in more of a shoulder-to-shoulder manner with the mentees, which can be seen in the lesson reflections, and during the negotiation of possible milestones and strategies (sections 4.2.3 and 4.3.3). This balance was evident during the later cycles at Hunter Primary School, when Angela's confidence increased, and between Kelly and Andrew, where a collegial and mentoring relationship existed. This balance of power between these mentors and mentees allowed the participants to contribute more equally towards decisions about the mentees' professional development.

However, the discussions between Kelly and David, and between Jennifer and Debbie, while still collaborative, appeared to be more mentor-led. The decisions for milestones and strategies appeared to be made primarily by the mentors, after which the mentees would agree to these mentor-made decisions without either a depth of interaction or mentee input. An example of the ways in which the mentors led the discussions differently can be seen at River Primary School in section 4.3.3, where the earlier interactions between Kelly and Andrew revealed more collaborative planning, while the latter interactions showed David dictating milestones and goals for Kelly.

It seems that Sarah's lack of confidence in her own integration abilities (Table 4.4.2) underpinned the unique way in which Sarah and Debbie interacted. Sarah's lack of confidence in integrating interactive technologies placed her on equal footing with Debbie and, in conjunction with the existing mentoring relationship, allowed for the same collaborative approach to mentoring that was described above with Rob and Andrew, at Hunter and River Primary Schools respectively.

The differences in the interactions and relationships revealed by each case study suggest that a number of factors can contribute to the mentoring relationship and interactions. These are:

- the mentoring ability of each mentor. A strong ability aided the management of the relationship and guided the discussions so that the mentees had opportunities to drive their own learning.
- the confidence of both the mentee and the mentor in the mentoring content. In two separate cases, the participants' confidence affected how the interactions occurred during the reflection meetings. Angela's increasing confidence allowed her, towards the end of her case study, to make more decisions about her growth, and negotiate milestones and strategies for her learning. This is in line with Haine's (2015) premise that the perception of affordances is specific to individual teachers. As Angela grew in her ability to integrate technology and increased her understanding of her learning space's affordances, she was able to discuss these and

how to take advantage of them more confidently with her mentor. Conversely, Sarah's lack of confidence in the content area forced her to rely more on Debbie's skills to negotiate appropriate strategies.

This suggests that as the balance of power shifted, based on the changes in the mentor-mentee relationship and the participants' confidence, the ways that the mentors and mentees interacted and collaborated also changed.

Other features of successful mentoring, such as greater support, encouragement and positive feedback, were more commonly seen in those relationships that were more positive. This was especially true where relationships already existed, regardless of whether they were mentoring, supervisory or collegial. Evidence of these features, strategies and aptitudes are discussed in greater detail under the following section relating to the mentor.

5.2.2 The 'right' mentor

The relationship between the mentor and mentee has implications for the mentoring approach and its effectiveness, as outlined in this section. Maor and McConney (2015) explained that a positive mentor-mentee relationship primarily relies on the mentor. Therefore, those features that indicate a 'right' mentor must be examined and presented contextually, as the mentor-mentee relationships differed at each school. These features will be discussed within the categories of mentor support, expertise and motivation.

The findings from the case studies showed that the mentors who were the most supportive were at schools where the relationships were the most established. This appears to be consistent with other studies, which suggested that effective mentors would have the aptitude to be supportive and encouraging (Kraft et al., 2016) and the skills to act on this aptitude (Garbacz et al., 2015). In this study, Hunter Primary School provided the most evidence that was consistent with the findings from the cited literature and of support for the mentee (section 4.2.1). Rob gave Angela strategies to facilitate not only growth when integrating technology, but also her growth as a teacher. An example of this is found where Rob identified milestones that related to pedagogies other than the integration of technologies (section 4.2.3). This deep understanding of Angela's needs as a teacher appeared to have stemmed from his previous role as Angela's practicum supervisor. Rob closely individualised Angela's learning, a feature defined as an effective mentoring practice by the literature (e.g. Mansfield & Thompson, 2017; Nolan et al., 2013), and which resulted in him extending support to Angela both within and outside of her learning spaces. For example, he offered to provide support through planning and designing learning activities during the reflection meeting of the fourth cycle, as seen in the excerpt below.

Rob:	Maybe if I don't come in and observe the actual teaching, but we look at *File Management* side of things …
Angela:	Yeah, I'm a bit lost there.
Rob:	… and the prep time for the lesson.
Angela:	That'd be really helpful to me, yeah.

[April 3, 2017]

Another example of a highly supportive mentor was Andrew from River Primary School. The co-teaching model seen there was unique to this case but resulted in Kelly's high level of appreciation for this type of hands-on support (section 4.3.1). To facilitate Andrew's ability to observe Kelly's lessons, Andrew and Kelly combined their classes together, meaning that Kelly was required to teach a much larger class. Comparing Kelly's response to Andrew's co-teaching approach with David's mentoring approach, in which he preferred to be removed from the class activities, shows that Kelly was more appreciative of Andrew's level of support. Similarly, Sally at Ridge Primary School expressed appreciation for Allan's hands-on approach (section 4.1.1), where he dealt with technical and student learning issues during her lessons. Further evidence of Allan's hands-on approach was seen during the mid-study visit, where he was observed dealing with the numerous problems arising from the laptops and then working with Sally's students in the latter part of the lesson. In both cases, Kelly and Sally revealed their appreciation for their mentors' hands-on approach to support.

While the hands-on approach did not appear in the other cases, its absence did not reduce the other mentees' feelings of support. In the survey, all mentees responded that their mentors were both available for support and were supportive. All, except Sally from Ridge Primary School, strongly agreed with these mentor aptitudes (Tables 4.1.1, 4.2.1, 4.3.1 and 4.4.1). It is worth noting that Ridge Primary School was also the case that showed the comparatively weakest relationship between the mentor and mentee. The initially weak relationship at this school seemed to result in less collaborative practice, reflection and supportive strategies (section 4.1.3), especially during the first two cycles. The quality of the relationship and these manifestations of Allan's mentoring may have impacted on Sally's perception of support.

A comparison of the depth of interaction and the strategies used by Allan from Ridge Primary School, across the three cycles, suggests that the effectiveness of a mentoring model may be affected by the mentoring strategies used. Strategies such as providing feedback to the mentees and explaining concepts appeared to have strengthened the mentoring presented in each case. Given that reflection is a feature of effective professional learning (Wang et al., 2014b), feedback was expected as part of the mentoring in all cases. Feedback provided a way in which the mentees could reflect on their own practices. It allowed the mentees to identify, from their mentor's point of view and expertise, teaching behaviours during the lesson that were more effective or were areas for improvement. Feedback provided a way for the mentors in this study to reinforce mentee behaviours used when integrating technology, and provided avenues for the mentees' growth. Evidence of this was especially clear at Ridge Primary School, where collaborative reflection was more obvious during the third reflection meeting, when mentor feedback was also more evident (section 4.1.3). During this meeting, Allan's feedback allowed Sally to interact more intensely, producing discussions which gave Sally opportunities to reflect in greater depth about her practice and which provided her with strategies that she could attempt in her learning space, such as seen in the following excerpt.

> Sally: And I did have to get around and help them log in. And some of them just weren't logging in. I couldn't even log them in. So that's hard.
>
> Allan: That's where you need a blue cable.
>
> [May 18, 2017]

Despite evidence of an increased range of mentoring strategies during the third cycle at Ridge Primary School, it does not appear that 'more' mentoring strategies resulted in increased mentee growth. A comparison of the number or types of mentoring strategies with mentee growth at each school did not show that these strategies directly affected mentee growth or any change in mentee attitudes towards the integration of technology. For example, the growth of the mentees at Hunter and Edge Primary Schools was similar. Both mentees started predominantly in Stages 2 and 3 of the framework and ended in Stages 4 and 5 (Figures 4.2.1, 4.2.3, 4.4.1 and 4.4.2). However, the strategies employed by the mentors varied. Both mentors encouraged and provided feedback, which were considered as behaviours that indicated effective mentoring (Hay Group, 2013). However, Rob from Hunter Primary School engaged with additional strategies, such as supporting Angela outside the classroom and asking probing questions to ensure her understanding (section 4.2.1). Comparing mentee growth between the two cases showed that similar gains resulted from the variation or different quantity of mentoring strategies. It appears, therefore, that it is more appropriate to suggest that the different mentoring strategies employed provide an arsenal for the mentor to facilitate mentee growth.

An examination across the cases highlighted the mentors' expert use of probing questions with their mentees was a common mentoring strategy. This strategy elicited deeper reflections from the mentees upon their lessons and their professional learning, and encouraged them to consider possibilities for the application of their professional learning. While this strategy was commonly used, its effectiveness was seen differently in the different schools. As stated in section 3.5.1, a set of suggested questions was provided to the mentors. In most cases, the mentors chose not to use these questions but rather relied on their own questions, which were more applicable to their context and the topics of discussion. However, at Ridge Primary School, Allan used the suggested questions rather than his own. This removed the possibility for individualising the mentoring to Sally's background and context, and is in contrast with the features of effective professional learning (Burke et al., 2015; Nolan et al., 2013). The questions were very generic, e.g., 'During the lesson, what did you see?', and they appeared to lead to Sally providing, during the first two cycles, less reflective responses and more of a recount of lesson occurrences (section 4.1.3). With more tailored questioning evident during the third reflection meeting, e.g., "Would you change the buddy system you had?", the resulting responses showed deeper and more collaborative reflection in this case. This more natural discussion and reflection resulted in stronger mentoring and greater support for Sally (section 4.1.3).

Similarly, an organic form of discussion and reflection allowed for a more effective use of probing questions in the other cases. For example, Rob from Hunter Primary School was very direct in his line of questioning. His questions were purposeful and elicited the reflection that he obviously was trying to get Angela to conduct (section 4.2.3). The questions targeted Angela's development needs, and provided her with strategies and directions that aimed to build her capacity in integrating technology, as well as in other areas of pedagogy. Similarly, Andrew and David adopted a targeted questioning approach for Kelly's development. Their focus, however, targeted Kelly's technology integration skills (section 4.3.3).

Edge Primary School showed two different approaches coming from the two mentors. While Jennifer's approach to the mentoring was similar to those of Rob, Andrew and David, Sarah did not use probing questions to the same extent as the other mentors. It appears the highly collaborative and equal nature of the mentor-mentee relationship between Debbie and Sarah changed the way these two participants interacted. This mentoring approach did not, however, appear to have affected Sarah and Debbie's engagement with the process. Debbie still had milestones for which she aimed and strategies to support her in achieving them. However, the collaborative nature of the relationship between Sarah and Debbie resulted in more detailed discussions to determine the milestones and strategies, and relied on Debbie to review her progress through self-reflection (section 4.4.3). While this is different to the way in which Jennifer approached the mentoring, where she worked with Debbie to review her milestones, the collaborative nature of Sarah's and Debbie's relationship supports the need in a mentoring partnership for an even balance of power, open communication and collaborative decision making (as described by Hudson & Hudson, 2016; and Kemmis et al., 2014).

An approach similar to Jennifer's was commonly used to identify milestones and provide strategies at Hunter and River Primary Schools. At Hunter Primary School, Rob initially took more responsibility in the identification and review of milestones, ensuring that Angela achieved previous milestones and providing appropriate feedback on her achievement (section 4.2.3). As seen in the same section, when Angela became more confident and the balance of power shifted, the negotiations about milestones became more collaborative.

The two mentors at River Primary School approached the determination of milestones and decisions about strategies in different ways. In particular, Andrew reviewed previous milestones and strategies with Kelly, while David did not. This is most likely for two possible reasons:

- David did not access the data from the cycles that Andrew was mentoring; nor was there any Review Form submitted by Andrew, which would have outlined previous milestones.
- While David conducted two observations, he was only able to conduct one reflection meeting with Kelly. The second reflection meeting did not occur, and therefore there was no opportunity to discuss in detail the previous lesson's observation.

From these reasons, it appears that rather than David not being able to demonstrate this mentoring strategy, he simply did not have the opportunity to do so.

Another mentoring strategy that was commonly seen across the schools was the use of the framework to assist in identifying the milestones (sections 4.2.3, 4.3.3 and 4.4.3). The framework was designed to support the mentors in identifying relevant learning goals, which is a feature of an effective mentoring approach to professional learning (Hay Group, 2013). The mentors at Hunter, River and Edge Primary Schools identified their mentee's current levels on the framework, and noted the next steps for their mentee using the access points as milestones. They followed this up by providing appropriate strategies to the mentees to assist them in achieving the milestones. The exception to this was Andrew from River Primary School. As indicated, there was no evidence that Andrew identified specific milestones for Kelly. While this may be an indication that Andrew did not adhere to the intended process of this study's model, it may also be attributed to the way he was mentoring, which was through a co-teaching approach.

The milestones set by Allan at Ridge Primary School did not align with the framework nor with any technology integration skills (section 4.1.3). The milestones showed technology use, rather than an integrative approach with the technology. This may suggest that while Allan was able to perceive the affordances of the technologies available in Sally's learning environment, he was not able to perceive these affordances in the context of teaching and learning. Without this, he may not have been able to guide Sally in developing her skills to perceive and take advantage of technologies' affordances specifically for the purpose of teaching and learning, in line with Brown (2005) and Gibson (1977). This, then, would limit her ability to realise the benefits of technology in education, which requires an integrative approach to technology (Bulman & Fairley, 2015; Hattie, 2013a). There was also no evidence that strategies were provided to Sally during the first two cycles. Despite Sally explaining that strategies were discussed outside their reflection meetings, there was no indication how these were negotiated or communicated. The simple milestones, combined with the lack of evidence regarding the provision of strategies, appear to reflect the mentor-mentee relationship at this school. It was not until the third reflection meeting that the technology integration strategies were more obviously suggested to Sally.

Despite Kraft et al. (2016) suggesting that mentoring skills and strategies are more important factors than others in their effect on successful mentoring, mentor expertise in the content area still appeared to be an important factor in the study reported in this thesis, as this expertise provided a foundation for the mentor to develop the same expertise in their mentees. In this study, this would equate to the mentors' skills when integrating technology into the curriculum. The initial design of the research study made some assumptions about the mentors' expertise. As the method of selecting the mentors and the mentees included approaching the schools' principals to nominate potential participants (section 3.3.3), it was assumed that the principals would have an in-depth knowledge of the teachers in their schools and, therefore, would only nominate those that were suitable mentors and mentees. However, in reality, this did not always occur. Mentor choice was sometimes made for practical reasons, or on the basis of the availability or willingness of potential mentors, rather than on an appropriateness of the potential mentor's expertise or experience. For example, Sarah was not nominated by the principal to be the replacement mentor for Debbie when Jennifer left the school. This might have been due to the fact that there was also a change in principal leadership at the same time that Jennifer and Debbie were looking for a replacement mentor (section 4.4.3). Although the new principal was apprised of the study, Sarah was not nominated as the new mentor by this principal, but instead became the mentor as a favour for Jennifer (Table 4.4.2). Also, being new to the school, the principal might not have been fully aware of Sarah's suitability as a mentor for Debbie. At River Primary School, where there was also a mentor change, Kelly mentioned that she felt the mentors and mentees were not carefully matched (Table 4.3.3). She did not provide any further detail, nor did she indicate whether her opinion related to one or both mentors. These issues appear to highlight the need for mentors and mentees to have established professional trust (as indicated by Mansfield & Thompson, 2017), and for them to share a deep understanding of contextual factors (as indicated by Hramiak & Boulton, 2013; and Kemmis et al., 2014).

In relation to the selection of appropriate mentors, it was further assumed that the mentors would have adequate abilities to support the development of knowledge when integrating technologies into the curriculum, including having expert knowledge themselves. Again, this assumption was not consistently realised. To use Edge Primary School as an example again, Sarah did not feel comfortable about acting as a mentor because of her self-perceived lack of expertise in integrating interactive technologies (Table 4.4.2).

Despite these assumptions, most mentors were able to demonstrate their TPK throughout their respective mentoring cycles. The only exceptions were Allan and Sarah. Evidence from Ridge Primary School showed Allan's expertise in only TK and PK (section 4.1.3). Similarly, there was little evidence of Sarah's TPK (section 4.4.3), aligning with her lack of confidence when integrating technologies. These exceptions, however, did not appear to have affected the mentees' perception of their mentors' skills.

From the survey, the mentees reported that all the mentors were adept at integrating interactive technologies, especially at River Primary School where Kelly strongly agreed to this statement (Tables 4.1.1, 4.2.1, 4.3.1 and 4.4.1). It is interesting that Debbie also agreed that her mentors were well-versed in integrating technology when, as mentioned, Sarah repeatedly expressed her lack of confidence in this area. It might have been that Sarah's ability to source others' expertise to aid her mentoring, as will be discussed later in this section, provided her with ways to support Debbie's ongoing development. Also, the literature explained that the quality of the mentoring is more important than other factors (Kraft et al., 2016). For these reasons, Sarah's mentoring expertise and her ability to source others' expertise to support her own content knowledge might have affected Debbie's perception of her mentor's skills. As both Debbie and Kelly, who had two mentors, did not provide any further details elaborating their responses to this question, it is assumed that they each considered both their mentors presented at least some expertise in integrating technology.

The evidence shows that mentor aptitude for both building capacity and technology integration varied across the cases. Despite this variation, the mentors facilitated the mentoring in their schools to exhibit features of successful mentoring that were outlined in Table 2.2. Some of these have already been discussed in this and previous sections of this chapter. Other demonstrated features were seen across the schools. Firstly, all four schools demonstrated aspects of shared planning (sections 4.1.3, 4.2.3, 4.3.3 and 4.4.3).

> Sally: From building on top of this, I probably would focus on maybe searching for things on the internet. And putting those into a *Word* document. We did have a few troubles with saving into *Collaboration* due to the fact that some kids don’t have *Collaboration* on their laptops.
>
> Allan: Like a network, yeah. You could possibly have a USB. Class USB ready to save [stuff] onto it.
>
> [May 18, 2017]

Another feature was that the mentors from three of the schools encouraged their mentees to experiment (section 4.2.3, 4.3.2 and 4.4.3).

> There's stuff like that where you can actually – the kids can write their story with their visual sequences. They can photograph their story and put it on there and then talk about the event that goes with it.
>
> [Sarah, Edge Primary School, September 21, 2017]

Also, most mentors highlighted evidence from the mentees’ practices (sections 4.2.2, 4.3.3 and 4.4.1).

> Website failed … you had a backup, not that it was planned. You knew where to access the same content in a different source, which was really, really good.
>
> [Rob, Hunter Primary School, March 24, 2017]

Finally, evidence of reviewing and action planning were seen in most schools (sections 4.2.4, 4.3.3 and 4.4.3).

Andrew: So if we think back to what we've learned from implementing the product that we just did, and creating the infographic and the *Piktochart*, what could be a possible timeline or sequence of activities, to lead up to creating the product?

Kelly: Well obviously the research component is vital … Guide them to the right websites …

[River Primary School, June 7, 2017]

As previously indicated, the observed features of successful mentoring were sometimes different in Sarah’s case at Edge Primary School from those at other schools, due to her self-perceived lack of skills in integrating technologies. Also, successful mentoring features, such as the latter three from those mentioned above, were not clearly evident with Allan at Ridge Primary School. When considering the absence of many of the features from Ridge Primary School, and despite Sally’s confidence in her mentor, Allan’s level of expertise when integrating technologies and in mentoring suggests that he may not have been an appropriate mentor for integrating technologies.

The variation in the mentors’ aptitude levels also suggests that ongoing mentor development was required, in both mentoring and in the content area. This need was also reported in studies by Maor and McConney (2015) and Nolan et al. (2013). These studies reported that a mentor who continues to develop their own capacity is better positioned to develop the same growth in others. As mentioned, evidence of this and the need for mentors to engage in their own development could be found at Edge Primary School, where Sarah frequently suggested that she herself needed support and mentoring, in addition to access to other teachers’ expertise (section 4.4.3). The need for the mentor to engage in their own development was further reinforced in this case when considering that one of Sarah’s motivations for her participation in this study was to engage in the ‘learn together’ approach, where she hoped to learn more about technology integration with her mentee (section 4.4.3). As mentioned, Sarah's ongoing development in technology integration facilitated her ability to support Debbie's own development, which possibly affected Debbie's perception of Sarah's expertise and her feeling of support from her mentor. Across the cases, the study provided opportunities for the mentors to develop, as shown in the mentors' responses to the survey. All mentors considered the professional learning model beneficial for them and most mentors reported personal growth (Tables 4.1.1, 4.2.1, 4.3.1 and 4.4.1). However, only the mentors from Hunter and Edge Primary Schools agreed that the process helped them improve when integrating technologies. Unfortunately, these mentors did not provide any further detail regarding their responses to this question and, therefore, it is unclear why the mentors at these schools benefited from this growth, while the others did not. However, Sarah's mentoring model of a 'learn together' approach may provide an indicator for her perceived benefits.

Those mentors who demonstrated notable mentoring skills (i.e. all but Allan), and who may have had existing relationships with their mentees, all agreed that the professional learning model added to their knowledge of the potential of ICT in teaching and learning. This is in line with Hudson and Hudson's (2016) assertion that mentoring builds on the mentor's experience. Across the cases, Allan reported the fewest mentor benefits when compared with the other mentors (Table 4.1.1). Also, the partnership at Ridge Primary School presented, when compared with the other schools, the least established mentor-mentee relationship. It would appear that the strength of the mentor-mentee relationship at this school, Allan's mentoring abilities, and the duration of Allan and Sally's engagement with the professional learning may have contributed to Allan's ability to acquire mentor benefits. The relationship, Allan's mentoring abilities and the duration of engagement could be speculated to be factors that most likely impacted on the mentor benefits, as they were features that differed most from the other cases. However, this cannot be definitively stated without further study into mentor benefits in mentoring relationships.

Another indicator of a good mentor, as reported by Maor and McConney (2015), is mentor motivation. Two cases presented particularly strong evidence of mentor motivation in participating in this study. Hunter Primary School presented strong evidence for Rob's altruistic motivation (section 4.2.3). Rob considered that the school culture needed to change so that teachers could build their capacity in integrating technology, as well as adopting more positive attitudes towards technology use. He endeavoured to increase exposure to ICT by means of professional discussion and learning. He took opportunities to have conversations with his peers about this topic, as well as conducting professional learning sessions when appropriate. Similarly, while Stuart did not end up engaging with the study, he considered that there may be potential for this current study's framework to facilitate teacher professional development and was thus initially motivated to participate in the study.

Edge Primary School presented evidence for both altruistic and personal motivation (section 4.4.3). The combination of personal and altruistic motivation was seen when Jennifer used the professional learning model to gain the leadership evidence necessary for Highly Accomplished Teacher accreditation level, as well as developing Debbie's pedagogical skills so that Debbie could gather the evidence for achieving her accreditation at the Proficient level. Sarah's altruistic motivation was her professional relationship with Jennifer, which motivated her to do a favour for Jennifer and take over as mentor (Table 4.4.2).

As there was little evidence of the nature of mentor motivation found at Ridge and River Primary Schools, it is difficult to detect any alignment between mentee growth and mentor motivation. To be able to more definitively make statements regarding this, further studies would need to be conducted.

5.2.3 Mentee attitudes and interactions with the learning process

The targeted recipient of a professional learning approach plays a strong factor in determining the professional learning's success. Maor and McConney (2015) explained that mentors in their study found greater success when their mentees were enthusiastic and receptive to the mentors' advice. Therefore, to comprehensively address the research question, an examination of the mentees' reaction to the learning is required, as this would provide an indication of their receptiveness to the professional learning and their commitment to their own professional development.

Angela, Kelly and Debbie all demonstrated behaviours that revealed their acceptance of the mentors' advice, and a commitment to implement feedback and advice into their teaching practices (section 4.2.3, 4.3.3 and 4.4.3). An example of this acceptance is exemplified by the interaction below from Edge Primary School.

> Jennifer: … I think it's [the professional learning] going good.
>
> Debbie: It is. And I'm learning a lot too.
>
> [June 16, 2017]

As advice and feedback were rare during the first two cycles at Ridge Primary School, there was little opportunity for Sally to demonstrate her willingness to implement feedback and advice. However, a commitment to grow was revealed by Sally's recounting of her lessons, where certain statements provided evidence of Sally's reflection on her teaching practices and decisions during the first two lessons, as seen below.

> The second lesson was a lot smoother than the first lesson … Some of them [the students] could remember how to access their email but didn't know how to compose an email …
>
> [Sally, March 9, 2017]

Although there was limited evidence from Ridge Primary School, all the mentors reported that their mentees were receptive to their suggestions, as seen in Table 5.4. This was strongly agreed upon by Allan, Rob and Andrew. Similarly, all the mentors reported that their mentees were eager to shift and demonstrate growth according to the framework, with Rob and Andrew strongly agreeing with this statement.

Table 5.4

Mentors' responses relating to mentees' engagement with the professional learning

My mentee was:	Allan	Rob	Andrew	David	Jennifer	Sarah
eager to shift and demonstrate growth according to the framework/process.	Agree	Strongly agree	Strongly agree	Agree	Agree	Agree
receptive to my suggestions.	Strongly agree	Strongly agree	Strongly agree	Agree	Agree	Agree
an active participant in the partnership.	Strongly agree	Strongly agree	Strongly agree	Agree	Agree	Agree

The mentors reported that their mentees were able to translate the two attitudes of mentee's 'eagerness' and 'receptiveness' into action, where they all agreed that their mentees were active participants in the partnership (Table 5.4). This active participation was further evidenced by certain mentee strategies at Hunter and River Primary Schools, where Angela and Kelly actively sought guidance and further feedback from their mentors (sections 4.2.3 and 4.3.3). This additional evidence of active participation appeared to have affected the mentors' perception of their mentees' eagerness to participate in this professional learning. As seen in Table 5.4, Angela's and Kelly's mentors, Rob and Andrew, agreed strongly with statements about the mentees' eagerness. Where this active participation was not seen to the same extent in the other cases, the mentors' responses in general, while still positive, were weaker. It should be noted that David had different responses to Andrew about the same mentee. However, as discussed under mentor-mentee relationships (section 5.2.1), the nature of David and Kelly’s relationship, and the fact that David might not have been able to establish and maintain Kelly’s confidence in the learning process (as deemed necessary by Hay Group, 2013), would most likely to have affected Kelly’s engagement with the professional learning. This suggests a possible reason for David’s weaker responses to these statements.

5.2.4 Educational system and school leadership support

Educational system and school leadership support was a factor that was previously shown to have an impact on teachers’ integration of technology (in section 5.1.2, and in, for example, Eikelmann et al., 2017; and Hramiak & Boulton, 2013). However, the evidence from this particular study suggests that this support is also required to facilitate effective professional learning. In addressing the second research question, educational system and school leadership support presented two sub-factors. The first, which resonated across all the cases and was seen as essential, was the need for time, or RFF, to conduct the mentoring. The second factor was the need for direct support from school leadership to engage with the professional learning.

The design of this research study meant that additional time was primarily required by the mentors so that they could be released to observe the mentees’ lessons. A need for time is further supported by studies such as Carter et al. (2016) and Ng (2016), which suggested that teachers require time to engage with professional learning. In particular, Hardy et al.’s (2017) study found that time is needed to allow for professional discourse in order to facilitate teacher growth.

The evidence from Ridge Primary School especially supported this need. As described in section 4.1.3, the DP initially supported the professional learning process, monitoring its progress and providing release time for Allan to observe Sally. During this time, Allan and Sally were able to engage with the process more easily, when compared with the time when the DP no longer provided support, due to her absence on leave. This evidence was particularly stark, since Allan could not engage with the third cycle until a long time after the second. His difficulties in engaging with the process, and proceeding beyond the third cycle, were obvious from his email communications, as seen below.

> … we didn't get release time for our lesson this week and won't get it again next week due to it being the last week etc.
>
> [March 30, 2017]

Across all the schools, only Allan was afforded more time to observe his mentee's lessons. Despite the lack of time afforded to the other mentors, only Andrew from River Primary School felt that the professional learning model was not manageable in terms of time. This was revealed by his email communications (section 4.3.3) and from his survey response (Table 4.3.1). The data did not reveal what factors contributed to this issue, especially when David, from the same school, considered the professional learning model was manageable with respect to time (Table 4.3.1).

Despite all mentors except Andrew agreeing that the professional learning model was manageable in terms of time, they all made suggestions that additional time would have been beneficial. Jennifer, in particular, suggested that more time would have made the process more efficient (Table 4.4.1). She explained that she was using her RFF and out-of-school time to engage with the process. Jennifer stated that while it was still manageable using her non-teaching and personal time, this was not preferable. Andrew also found the use of personal time to engage with the process onerous (Table 4.3.1).

It is interesting to note that two out of the four mentees disagreed that time was manageable in this process. As stated, additional time was primarily required by the mentor. The time commitment for mentees was only for their participation in the reflection meetings. From the length of the recordings of the reflection meetings, most of these did not extend beyond 15 minutes per meeting. It was assumed that this time could be considered within the mentees' professional learning or planning time, and may be allocated to teachers through the schools' operational funding (DoE, 2018f). However, as suggested by Kelly, other school priorities may cause mentee engagement with the process to become an additional burden (Table 4.3.1). This indicates, again, a need for school leadership support to prioritise this or any other form of professional learning, and to minimise any impact on teacher workload. In providing an explanation, Sarah stated that a school's strategic directions may not include the use of ICT or improving its integration into the curriculum (Table 4.4.1), and therefore it is hard for school leadership to support any professional activity in this area.

Another factor that emerged relating to school leadership was direct support. As stated, at Ridge Primary School, the DP not only arranged time but also monitored the progress of the process. This resulted in positive feedback from both Allan and the DP (section 4.1.3). Problems arose only when the DP went on leave. Similarly, Tableland Primary School had issues releasing Stuart to engage with the lesson observations, seen in the fifth case in Chapter 4. As there was a student with particular needs in his class, Stuart felt it necessary to remain with this student during his RFF time and therefore was unable to conduct any observations. This may have been mitigated by providing additional support for the student, releasing the mentor at other times by rearranging the timetable, or providing additional time. These measures would have provided a solution, as Stuart indicated that he only needed to remain with this student during the morning sessions. While there is a need for educational system and school leadership to promote a culture of technology integration, as discussed in section 5.1.2, there appears to also be a need for leadership support for teachers to engage in any professional learning activity. The fact that these teachers' leaders were not able to provide the necessary support resulted in the mentees' inability to engage with the mentoring and limited their ability to build confidence and capacity when integrating technologies, as it did for the teachers in Hramiak and Boulton's (2013) study.

Research Question 3
In what ways can a structured technology integration framework facilitate professional learning?

The framework and the supporting templates developed for this study were considered as 'draft' versions, as stated in section 3.4, to be tested in the case studies so that they could be refined into the final versions. As described in section 3.4.1, the draft framework (Figure 3.2) used in this study adapted four other technology integration frameworks. In alignment with a constructivist approach adopted in this study, the draft framework synthesises the knowledge of technology integration described by the previous four frameworks and then aimed to add to this knowledge through the participants' use of the draft framework and their feedback. In order to achieve this and to address Research Question 3, the toolkit, comprising the professional learning model, the framework and the templates, needs to be evaluated for its impact on the professional development of the mentees and examined according to the way it was implemented by the participants. This suggests two essential areas for exploration. Firstly, the results of the professional learning will provide an indication of the effectiveness of the toolkit. Second, there needs to be a detailed examination of how the schools used the framework to support their implementation of the professional learning model. This includes the templates in the toolkit, since they provide support mechanisms when using the framework and implementing the professional learning model. This examination, in combination with more direct feedback from the participants, should reveal how the framework supported the professional learning and should indicate the necessary refinements to the framework to better support the professional learning model. With these two areas for exploration in mind, the following sections will organise the findings from Chapter 4, which were primarily grouped under the category of 'the impact of the professional learning model and the feedback on the toolkit', firstly by the professional learning results, and then the feedback relating to the framework, the professional learning model and the supporting templates.

5.3.1 Professional learning results

Despite variations in relationships and mentoring effectiveness, as in relation to Research Question 2, all mentees evidenced growth. In this study, growth was designed to be determined by comparing the submissions of the beginning- and end-of-study Recording Tools (Appendix E). However, some of the mentors indicated their mentees' level against the framework on other templates, such as directly on the framework in the case of River Primary School (Figures 4.3.1, 4.3.2, 4.3.3). Regardless, these submissions were used to measure the mentees' achievement against the framework (Figure 3.2), which was, as described in section 3.4.1, originally designed under the same structure as Beauchamp's (2004) and Sweeney's (2008) IWB frameworks. The framework presents a progressive model for skills and behaviours that reflect increasing TPK, as in the TPACK Framework (Koehler, 2017; Mishra & Koehler, 2006), and would allow the teachers to realise the potential affordances of technology in education, as described in section 2.1.1. At Ridge Primary School, with its reduced engagement with the process, Sally moved up only one stage. It was difficult to gauge Sally's growth, as Allan labelled their only submission of the Recording Tool (Figure 4.1.1) with 'L1' and 'L2'. Assuming that 'L1' and 'L2' indicate Sally's levels during Lesson 1 and Lesson 2 respectively, then Allan did mark Sally's growth sequentially. This was initially required as part of the research design (section 3.4.3). However, following the initial analysis of Hunter Primary School's data (section 4.2.5), this sequential checking of the mentee achievement was no longer required. As Allan did not submit another Recording Tool that would have indicated Sally's achievement beyond the second cycle, it is unclear what Sally's end level achievement was, and whether the change in Sally and Allan's mentor-mentee relationship affected the professional learning result at this school.

Hunter Primary School provided more evidence of mentee growth. A comparison of the beginning-of-study with the end-of-study Recording Tools (Figures 4.2.1 and 4.2.3) revealed a large amount of growth. Angela moved from having her highest achievement levels at Stage 3 of the framework to having most of the access points in Stage 5 achieved by the end of the study. Similarly, Debbie, from Edge Primary School, demonstrated a large amount of growth, moving from most of the access points in Stages 2 and 3 to achieving in Stages 4 and 5 (Figures 4.4.1 and 4.4.2).

Despite Angela's positive change in achievement, there was some fluctuation in her growth. As explained in section 4.2.4, Rob marked Angela's achievement every week. So, when Figures 4.2.1 and 4.2.2 are compared, it should be noted that the access point MS4c, from *Mechanical Skills*, was no longer marked after the second cycle. A similar pattern was seen with Kelly from River Primary School. When comparing Figures 4.3.1 and 4.3.2, it is important to note that Kelly's achievement in Stage 5 was not recognised by David at the point when the school changed mentors (Figure 4.3.2). Similarly, achievement in MS4a, MS4b (both from *Mechanical Skills*), PV4b (from *Program Variables*) and all of Stage 4 in *Classroom Management and Pedagogy* were no longer evident. A comparison of Kelly's achievement at the time when David took over (Figure 4.3.2) with her achievement at the end of the study (Figure 4.3.3) shows that there was no notable shift in achievement. As a strong relationship is crucial to an effective mentoring partnership (Hudson & Hudson, 2016), the limited growth in Kelly's achievement after David took over as mentor may have been the result of the new mentor-mentee relationship between Kelly and David, or that the professional learning model delivered by David did not have enough time to take effect. It is also possible that the particular access points mentioned above or the domains from which they came affected the fluctuation in

Kelly's growth. However, there was also not enough evidence to confirm these reasons.

There may be some other reasons for the large fluctuation in Kelly's growth. For example, there may have been a difference in the way the two mentors interpreted the framework, as Figure 4.3.1, specifically the blue highlighting, and Figure 4.3.2 were completed when the mentors changed. While Figure 4.3.1 showed Kelly achieving at Stages 4 and 5 by the time Andrew finished as her mentor, Figure 4.3.2 showed David's assessment of Kelly's level when he took over. As Jennifer from Edge Primary School did not submit a Recording Tool when this school changed mentors, it is difficult to state whether a change of mentor would affect any movement in mentee achievement, although it might well be expected that it could.

These reversals in the mentees' development appear to strengthen the hypothesis reported in section 4.3.4, where the discussion with David suggested that the movement of a mentee's achievement cannot simply be a linear progression. Rather, depending on the technology used and the curriculum content, a teacher may demonstrate different teaching behaviours, reflecting their skills and confidence in using particular technologies, and their confidence in delivering the different curricula. Niess (2011) explained that there were complexities in adapting PCK and TPACK into pre- and in- service teacher training programs. This study supported this conclusion as it revealed that a teacher's growth and achievement when integrating technology is more complex than initially imagined at the point of research design, and consideration is needed for a wider scope of different factors which might determine growth. It appears that growth can only be ascertained when considering the way in which skills transference can be seen across different technologies and the various curricula. Further studies in this area might provide more evidence for this theory, where prolonged exposure beyond the six cycles to a particular technology or curriculum content might show more linear mentee growth or a clearer learning progression in these areas.

Despite this added complexity, it appeared that the mentees' confidence was strong by the end of each case study. This is revealed by the fact that all mentees felt confident to mentor others in integrating technology by the end of the study (Tables 4.1.2, 4.2.2, 4.3.2 and 4.4.2). Evidence of the mentees' growth in confidence can be more obviously found in two schools. Firstly, Debbie from Edge Primary School perceived that her confidence had grown as a result of the mentoring (section 4.4.2). Secondly, Angela from Hunter Primary School grew in confidence throughout the study (as discussed in section 4.2.2), from hesitantly providing her Kindergarten students with a device, as seen in the first excerpt below, to demonstrating a willingness to manage multiple technologies to facilitate lesson delivery and flow, such as seen in the second excerpt.

> So I could have … even possibly risk an iPad, rather than having my phone there.
>
> [March 17, 2017]

> Making my own lessons, rather than just bits and pieces. Sort of adding it as one big lesson. And it's all there. I don't have to flip around.
>
> [May 12, 2017]

In particular, Angela's management of multiple technologies to take advantage of her teaching and learning time reflects one of the beneficial affordances of technology to extend learning time (as described by Bulman & Fairley, 2015; and OECD, 2015).

Similar to the mentees, all mentors were willing to continue to mentor others after the study (Tables 4.1.2, 4.2.2, 4.3.2 and 4.4.2). The only exception to this was Sarah. Sarah's lack of confidence at the end of the study is understandable, since she had indicated that her motivation to be a mentor for this study was only as a favour for Jennifer (Table 4.4.2) and frequently reported her lack of skill when integrating technologies.

The mentees' reflections on their personal growth in the survey yielded mixed results. All but Sally considered the professional learning model had helped them improve their integration of technology (Tables 4.1.1, 4.2.1, 4.3.1 and 4.4.1). Each of their responses aligns with their achievement against the framework. However, only Angela and Debbie agreed that their pedagogies changed as a result of this professional learning (Tables 4.2.1 and 4.4.1). Two factors emerged as plausible rationales for the mentees' responses:

- Both Angela and Debbie were reasonably new teachers, and there was therefore probably more potential for any professional learning to impact on their pedagogies in comparison to more experienced teachers.
- The access points, especially at the higher end of the framework, were intended to indicate more revolutionary change in teacher pedagogies, and how teaching and learning may be conceived in learning spaces. Angela and Debbie were the only mentees who showed achievement at these higher ends, as seen in Figures 4.2.3 and 4.4.2.

For these reasons, it is understandable that Angela and Debbie considered their pedagogies changed, while the others did not.

Sally's survey response, where she disagreed that the process has helped her improve her integration of technology (Table 4.1.1), may be because the participants at Ridge Primary School did not have as long an exposure to the professional learning model as the others. Professional learning is more effective when it is prolonged, ongoing and continuous (Ernst & Erickson, 2018; Hramiak & Boulton, 2013; Whitworth & Chiu, 2015). These features were not evident at Ridge Primary School. As the participants from this school were only exposed to the professional learning model for two cycles before an extended break prior to engaging with the third cycle, this would indicate that the model at Ridge Primary School did not have adequate time to work. Furthermore, the professional learning model at Ridge Primary School was neither ongoing nor continuous.

The lack of time was further exacerbated by the fact that this particular mentor-mentee relationship was not built on any existing relationship. Therefore, this partnership required more time to establish their mentor-mentee relationship. This was especially obvious when, by the third cycle, the relationship was further developed and the mentoring became more effective (section 4.1.1).

5.3.2 Feedback about the framework

The feedback about the framework can be split into two categories, by function and by design. Feedback about function relates to the content of the framework and how it facilitated the implementation of the professional learning model. Feedback about the design relates to the aesthetics, the language and the layout of the framework, which aided its accessibility. The following sections will separate the feedback into these two categories. Also, the feedback will be viewed in light of the original design considerations discussed in section 3.4.1, as well as the literature surrounding the four original technology integration frameworks from which the framework in this study is derived.

Function

Feedback about the framework's function was mostly positive. The initial design of the framework followed a structure similar to Beauchamp's (2004) and Sweeney's (2008) IWB frameworks. Designing the new technology framework this way, as explained in section 3.4.1, provided a scaffold with which the teachers could identify their existing skills and the steps to acquire greater skills when integrating technologies. While acknowledging the beneficial affordances of technology in education, as outlined in section 2.1.1, and adapting the two IWB frameworks with the skills identified in the TPACK Framework (Koehler, 2017; Mishra & Koehler, 2006), the design of the draft framework must continue not only to provide the mentioned scaffolded approach, but also to adapt the framework to encompass a broader variety of technologies, skills and dispositions. The evidence from the study showed that this was achieved, as all the mentors agreed that the framework gave them the tools they needed to identify their mentee's skill levels and assisted them in providing practical advice to facilitate mentee growth (Tables 4.1.3, 4.2.3, 4.3.3 and 4.4.3). While Stuart did not test the framework at his school, he saw that there may be potential in the framework for teacher professional learning, as seen in his email in Chapter 4. As indicated in section 5.2.2, the mentors at Hunter, River and Edge Primary Schools referenced the framework during their implementations of the professional learning model, indicating that they perceived the framework to be useful. The lack of reference to the framework by Allan suggests two possible explanations:

- he did not consider the framework useful
- he, and Sally, did not fully comprehend the process.

The latter seems more likely, since, despite both Sally and Allan indicating that they understood the process during the pre-study meeting, feedback from this school reported that the participants needed more guidance and did not have a full understanding of the distribution of labour (as deemed necessary in action research by Mattsson & Kemmis, 2007), particularly with the instruments supporting the professional learning model (Table 4.1.4). This was reinforced by the need to conduct an additional visit to confirm their understanding of the model. Also, Allan's survey response (Table 4.1.1) showed that he found some value in the framework, when he agreed that the process and the framework were beneficial to him as a mentor.

The framework's usefulness was further supported by the feedback found in the participants' survey responses and other sources. Emphasising the efficacy of the new technology framework's structure in scaffolding teachers' skills in integrating technologies, all participants, except those from River Primary School, reported that the framework provided them with a good scaffold for ICT integration skills (Tables 4.1.4, 4.2.4 and 4.4.3). This evidence was further supported by Jennifer's elaboration of her response:

> … [the framework] was a great scaffold for reflecting on practice and developing ICT skills in both the mentor and mentee.
>
> [Jennifer, December 16, 2017]

In particular, Hunter Primary School reported that the framework was detailed, and that it explicitly described the goals for a mentee and the steps required to achieve these goals (Table 4.2.4). Rob stated that the framework highlighted gaps in a teacher's knowledge so that these gaps could be addressed. This feedback is especially pertinent, as it suggests that this framework supports a tailored approach to professional learning. Rob's high regard for the framework is further reflected by the fact that he was using the framework with teachers other than Angela. Rob's use with multiple teachers showed that the framework also successfully navigated, from a single mentor's point of view, the different teachers' levels of PK, which all teachers to varying degrees should have (Shulman, 1986), TK and potentially TPK. Their TPK, in particular, would reflect the access points towards the higher end of this study's framework. Rob's high regard for the framework was echoed by Hunter Primary School's IT committee (Table 4.2.4), and by Andrew and Jennifer. Andrew indicated the framework's usefulness especially for beginning teachers (Table 4.3.2) and Jennifer looked forward to using the framework again (Table 4.4.3).

Jennifer's future intention to use the framework was echoed by the other mentors, who reported in the survey that they would continue to use it (Tables 4.1.2, 4.2.2, 4.3.2 and 4.4.2). It is surprising, however, that all the mentees, except for Debbie, suggested in the survey that they would stop using the framework. This indicates that the framework's usefulness and value are more mentor-oriented, rather than it being an instrument for personal development.

Design

The most common feedback about the design of the framework pertained to its language. While the participants from Hunter Primary School praised the explicitness of the framework, there was some criticism about the language. In particular, participants from Ridge Primary School felt the language should be simpler (Table 4.1.4), and, similarly, Kelly from River Primary School suggested the language needed to be more 'teacher friendly' (Table 4.3.4). Another criticism came from Rob and a member from Hunter Primary School's IT committee, who suggested that the word 'stage', used to delineate the different levels of the framework, might confuse teachers, who might assume it refers to curriculum learning stages (Table 4.2.4). To ensure that the framework remains simple and straightforward, as are the two IWB frameworks (Beauchamp, 2004; Sweeney, 2008) and the SAMR Model (Hamilton et al., 2016), this will need to be addressed, as will be discussed in section 6.2.

Despite these criticisms surrounding the framework's language, nearly all the participants considered the framework easy to follow (Tables 4.1.3, 4.2.3, 4.3.3 and 4.4.3). Jennifer, in particular, reported that the framework was very user friendly. The only exception to this opinion was expressed by Kelly from River Primary School (Table 4.3.3). Her request for the language to be simpler provides a rationale for her response.

5.3.3 Feedback on the professional learning model

As with the framework, the feedback on the professional learning model was mostly positive. In particular, Angela stated that she felt the professional learning model was beneficial and that it helped her grow in skill when integrating technology (Table 4.2.2). Jennifer also reported that she found the professional learning model beneficial in helping her and Debbie to establish and maintain a mentor-mentee relationship (Table 4.4.3). This valuing of the model was echoed by other respondents, as all the mentees, except for Kelly, agreed that it was more beneficial than attending the more common one-off courses (Tables 4.1.3, 4.2.3 and 4.4.3). Similarly, all mentors agreed that the professional learning model and the framework made it easier for them to mentor (Tables 4.1.3, 4.2.3, 4.3.3 and 4.4.3).

One important feature for successful professional learning, as described by Bridwell-Mitchell (2015) and Hardy et al. (2017), is the need for the learning to be sustainable. Sustainability was defined in two ways for the purpose of this study. Firstly, sustainability may refer to the capacity for the participants to continually engage with the professional learning process, which would rely on both educational system and school leadership support, and on the cost effectiveness of the process. A specific design element of the professional learning model was that the cost of the model should be less than sending a teacher to a one-off course, which would normally incur both the cost of the course and the cost of retaining a relief teacher. This cost would be compounded if the course was to be run over multiple days, requiring additional days of teacher relief. Therefore, it was not surprising that most of the participants agreed that the process was cost effective (Tables 4.1.3, 4.2.3, 4.3.3 and 4.4.3). Only Angela and Andrew disagreed about cost effectiveness. However, in the examination of the data, it is unclear what costs were incurred by these two participants, and they did not provide further detail relating to their responses.

The second way this study defined sustainability was the willingness of the participants to maintain ongoing engagement with the professional learning model. One factor that would contribute to this definition is the value that the participants placed on the model. Responses to this aspect were again positive. In particular, Angela commented that the professional learning model was especially pertinent for her context and highlighted the importance of ICT integration across her school (Table 4.2.2). The value the mentees place on the professional learning model might have contributed to the growth that all mentees' experienced, as this value was claimed by different literature (e.g., AITSL, 2014; Hadley et al., 2015) to be an important feature to consider when designing professional learning. The survey responses showed that nearly all of the participants intended to continue to work with their respective mentor or mentee in order to improve the mentee's level of ICT integration (Tables 4.1.2, 4.2.2, 4.3.2 and 4.4.2). It was not surprising to see that Jennifer disagreed with this statement, given that she had moved interstate. Similarly, Andrew elaborated on his response by explaining that he would have continued working with his mentee, if he had remained at the school (Table 4.3.2).

Kelly indicated that she would not continue to work with her mentor. She elaborated on this response by stating it would have been better if she had only had one mentor (Table 4.3.4). It is, therefore, unclear whether she would have continued to work with her original mentor, Andrew. It is possible that she may have wished to continue to work with her second mentor, David, if the opportunity arose, as she suggested that this would aid the transition between her two mentors (Table 4.3.4). Kelly did, however, indicate that there was some value in having two mentors, as she was able to access the mentors' different expertise.

5.3.4 The supporting templates

The final category of feedback is about the supporting templates. The templates were designed to assist in the implementation of the professional learning model and to relate directly to the framework. To understand the necessity for any changes needed to these templates, this section will consider both how the templates were used at each school and the direct feedback provided by the participants. The templates that will be examined are the Field Notes Template, the Recording Tool and the Review Form. All the templates used in this study were designed to both gather the necessary data and as a way to support practices that indicate effective mentoring and professional learning, such as reflection (Wang et al., 2014b) and individualisation of the learning (AITSL, 2014; Jensen et al., 2016; Whitworth & Chiu, 2015). It was with these practices, outlined in section 2.1.1, in mind that the use of the templates to support the mentoring in this study were examined.

The Field Notes Template, as indicated in section 3.4.2, was not designed to be an essential template for either data gathering or specifically supporting the professional learning model. It was initially intended to provide the mentors with a structure in which they could note down significant behaviours and actions during the lesson observations. During the pre-study meeting, it was explained that while this template could be used, the mentor should adopt whatever note capturing methods that were most natural to them. Despite this, most mentors used the Field Notes Template. Only Andrew and Jennifer did not use this template. Andrew's approach to mentoring, that is to team teach with Kelly, provided an obvious reason for his lack of use of this template, since his hands-on approach would not have allowed him the opportunity to take notes during the lesson. However, the data did not reveal any particular reason for Jennifer's lack of use of the template, nor did she submit any other form of note taking. Regardless, both mentors were able to effectively reflect on the observed lessons with their mentees. Also, despite the nearly universal use of this template by the mentors, a relationship between the concepts discussed during reflection meetings and the field notes could only be found at Hunter Primary School, as seen in section 4.2.3. The use of this template suggests that, as initially proposed, the template was useful but not essential. It is, therefore, surprising that there was a high level of use of this non-essential template, when compared with the use of the two essential templates.

Only Ridge and Hunter Primary Schools submitted the Review Forms. The data showed, however, that these schools were not unusual in noting down milestones. Sarah, from Edge Primary School, noted milestones, but used the Field Notes Template rather than the Review Form. Similarly, Jennifer from the same school also identified milestones during the reflection meetings, as seen in section 4.4.3, but these milestones were not submitted or may not have been recorded.

The variation in the use of the Review Form and the other templates can be attributed, at least partially, to the participants' understanding of how these supporting templates would assist the professional learning model. This was especially obvious when comparing those mentors who started mid-study and the way in which they engaged with the pre-study process. An offer to conduct a second pre-study meeting was made to both new mentors as they adopted their roles. As described in section 3.3.3, while Sarah accepted this offer, David did not. For this reason, David did not have the same opportunity as other mentors to clarify the intended structure of the process and how to use the instruments prior to his first cycle. It also appeared that, as seen in section 4.3.4, Andrew did not pass on any information or instructions to David. Conversations with David during the mid-study meeting, as described in the section on Case 3 in Chapter 4, provided evidence that he did not fully understand either the process or the instruments involved. His lack of understanding of the process and instruments may, therefore, have contributed to his failure to use the supporting templates and to submit any Review Forms. Also within an action research model, the distribution of labour must be clearly understood by all participants (Mattsson & Kemmis, 2007). David's lack of understanding about his responsibilities and the structure of the professional learning might have affected

Kelly’s perception of the professional learning model, as will be discussed further in the following section. As David had only one reflection meeting with Kelly, there was no opportunity to remedy this misunderstanding before the end of the case study. This, however, does not account for the fact that Andrew, from the same school, also did not submit any Review Forms.

The Recording Tool was also used sporadically across the schools. The variation in the usage of this template was extensive. Ridge Primary School only submitted one completed template (Figure 4.1.1), which may have been due to the unexpected termination of the study after the third cycle. The mentors from River and Edge Primary Schools marked the mentees’ achievement directly on the framework. It is unclear why the mentors from these schools did not use the Recording Tool. Rob was the only mentor that noted his mentee’s achievement at the beginning and end of the study on the Recording Tool (Figures 4.2.1 and 4.2.3). He further used the Recording Tool for every cycle to monitor Angela’s progress, such as seen in Figure 4.2.2. The sporadic use of the tool by the other participants was not wholly unexpected. While the tool was intended to be used as an essential template, as indicated in section 3.4.3, it was only necessary to track mentee growth for the six weeks of the study. In the case of an ongoing and continuous professional learning model, mentee growth can be tracked in different ways. Therefore, the sporadic use of this tool, especially the lack of its use by the mentors at Ridge and Edge Primary Schools, suggests the non-essential nature of this template. This suggestion is further supported by the supposition that a mentee’s skills might vary based on curriculum content and the technology, as seen in section 4.3.4. This is in line with Haines (2015), who explained that a teacher’s perception of a technology’s affordances can be affected by the teacher, their experiences and their intentions for teaching and learning. Therefore, it would be inappropriate to mark a mentee’s achievement progressively, where backward movements can, and should, be expected. A longer time engaging in the professional learning model might find more appropriate use for the tool, where a mentee might consistently use a single form of technology or curriculum topic over many more weeks. This, combined with Rob's frequent use of the template, suggests that it is better to include the template as part of the toolkit, rather than remove it. This would allow future users to decide whether to use the template.

Despite the variations in the use of the supporting template across the schools, all participants, except for Kelly, indicated that the professional learning model, framework and the templates were useful and important (Tables 4.1.3, 4.2.3, 4.3.3 and 4.4.3). This positive assessment was also reinforced by the mentors' responses, who unanimously agreed that the professional learning model, framework and templates assisted in making it easier for them to mentor.

5.3.5 Final remarks on the feedback

In reviewing the feedback on the framework, professional learning model and supporting templates, it was Kelly who was the most critical. The reasons behind Kelly's criticisms are unclear, but some speculations could be made from the specific nature of her feedback. Her dissatisfaction appeared to have stemmed from the poor pairing of the mentors (Table 4.3.3), the change in the mentoring partnerships (Table 4.3.4), and the lack of time to release her from other responsibilities (Table 4.3.1). In consideration of these particular issues, it was concluded that the contributing factors were unrelated to the professional learning model itself but, rather, related to school leadership support.

Kelly's criticisms also appeared to have stemmed from the formal data-gathering process. She felt that the additional process added stress in carrying out her professional responsibilities (Table 4.3.4). As indicated, the professional learning model did not intrinsically impose much additional responsibility on the mentee. Therefore, it is unclear where the 'stress points' may have been. The formal data-gathering processes appeared to have impacted on Kelly's perception of the professional learning model, which is consistent with Kraft et al.'s (2016) assertion that the structure of a mentoring process can affect participants' 'buy-in'.

While the data-gathering processes, such as recording the meetings and submitting these and the completed templates to *CloudStor*, were part of this study, these processes would not normally be part of the professional learning model. Regardless, such personal perspectives clearly impacted on the process, as it did for Kelly.

5.4 Summary of the discussion

This chapter discussed the findings revealed in Chapter 4 and used these to address the research questions. Studies in the area of technology integration are less common in primary school contexts (Blannin, 2015). The findings discussed in this chapter provide knowledge about technology integration in primary schools. They add to the research within the primary education setting, but also to the wider body of research relating to technology integration and education as a whole, consistent with a constructivist epistemological approach. This research has also added to those studies regarding professional learning and mentoring. The positive feedback on the professional learning model and framework showed that these were valuable contributions to the literature. Firstly, the high value that the participants placed on the professional learning model and the growth demonstrated by the mentees showed that this model is an effective method of professional learning with which to build teachers' capacity when integrating technologies. Also, the feedback from the participants showed that the framework captured the benefits of the four technology frameworks from which it is derived, and mitigated some of the limitations of the original frameworks, described in section 2.3, by adapting the collective benefits of these frameworks.

Throughout this discussion, certain implications and limitations emerged. Firstly, the findings and feedback relating to the framework suggest some revision of the draft framework was necessary. These revisions and a summary of the changes made to the framework will be discussed in Chapter 6. Chapter 6 will also consider other limitations and implications, such as those regarding the scope and scale of the study, and provide recommendations for future actions. These recommendations will include identifying opportunities for future studies in the area of technology integration and other necessary developments of the comprehensive toolkit, as seen at Appendix C.

CHAPTER 6
CONCLUSIONS, IMPLICATIONS AND RECOMMENDATIONS

The overarching purpose of this study was to provide primary school leaders and teachers with a sustainable professional learning model for building teacher capacity when integrating interactive technologies. To achieve this purpose, the following research questions were posed:

1. What factors influence the way primary teachers integrate interactive technologies in their learning spaces?
2. What features of a mentoring model can facilitate building primary teachers' capacity for integrating interactive technologies?
3. In what ways can a structured technology integration framework facilitate professional learning?

To address these questions, the research paradigm adopted in this study assumed pragmatic and constructivist theories, where it was necessary to examine the actions of the participants within their specific contexts. This allowed the study to determine how the participants' contexts affected their behaviours, and then to compare the resulting findings with those from other research in the areas of technology integration and teacher professional learning. This paradigm and the research questions suggested a predominantly qualitative approach, since such an approach is not restricted by any predetermined categories, and allows the researcher to carefully examine details (Patton, 2002) and identify patterns (Babbie, 2016). This approach therefore allowed the study to yield detailed evidence, facilitating the researcher to develop a deeper understanding of the findings, and thereby address the research questions.

With this approach in mind, a professional learning model, designed to build teacher capacity in integrating technologies, was implemented in four unique primary schools, with the fifth, Tableland Primary School, not being able to proceed with any action research cycles. An examination of these implementations of the model allowed the study to identify the factors that affect primary teachers' ability to integrate technologies and to engage with the professional learning model. The study also yielded evidence of the features that facilitate teacher professional learning and mentoring, and findings and teachers' feedback relating to the effectiveness and design of the professional learning model, framework and the supporting templates (known collectively here as the toolkit). This evidence was then used to refine the toolkit so that it could be more widely used by primary school leaders and teachers, therefore addressing the primary purpose of the study.

To conclude this study, this chapter will first provide a summary of the findings, followed by a description of the necessary refinements specifically made to the framework. Finally, this chapter will consider five key implications resulting from the findings discussed in Chapter 5. After an examination of these findings and the limitations of the study, the final sections highlight opportunities for future research and further development of the different components of the toolkit, before presenting some final personal reflections from the researcher.

6.1 Summary of the study

In order to design a suitable methodological approach to the study and an effective professional learning model, a comprehensive literature review was carried out, as seen in Chapter 2. This literature review examined other studies that revealed factors that affected teachers' ability to integrate technologies, features of effective professional learning and mentoring, and frameworks that indicate success criteria for technology integration.

The literature review firstly showed that technology cannot simply replace quality teaching. Rather, its beneficial affordances are realised when it is integrated with traditional teaching methods (Bulman & Fairley, 2015; Hattie, 2013a). The review revealed a variety of contested categories for factors that appeared to affect teachers' ability to integrate technologies, namely issues of access to technology, leadership, and teacher expertise and attitudes. Despite some areas of debate amongst the relevant studies, the literature review concluded that quality professional learning is required to ensure teachers have adequate knowledge of how to integrate technology, and how to translate this knowledge into practice. The literature review found that tailored professional learning that is well-designed, and that allows participants to collaborate and reflect appeared to yield better results in the development of the professional learning participant. This discovery suggested mentoring as a potential solution, as it exhibits many of the features that improve professional learning effectiveness. However, the consensus developing in the literature warned that mentoring should not be considered a panacea for effective professional learning. It concluded that for mentoring to be effective, there needs to be a careful selection of mentors and a strong mentor-mentee relationship. Four integration frameworks were examined in the literature review, suggesting ways to design a framework that would be best suited to support the professional learning model in this study.

The core points from the literature review suggested the methodological framework, described in Chapter 3, which could be used to address the research questions and design the professional learning model, the framework and the supporting templates. Participatory action research appeared to fit well within the assumptions of a pragmatic theory, where this method would allow for different 'truths' to emerge from each case. The iterative cycles of this method would work well in a mentoring model, as they target both participants' practices and their understanding of the contributing factors that shape these practices (Kemmis, 2009). This level of participant analyses is consistent with an interpretivist analysis approach. These action research cycles, employed in case studies, produced findings which were presented case-by-case in Chapter 4. Presenting the findings in this way allowed for a better understanding of the specific factors which affected each mentee's ability to integrate technology and of how the professional learning model was adapted at each school. The categories of the findings in Chapter 4, which resulted from the data analysis methods described in Chapter 3, provided the basis for the ways in which the research questions were addressed.

The first research question sought to identify the factors that affect primary teachers' ability to integrate interactive technologies. The findings from this study echoed factors and features found in the studies examined in the literature review in Chapter 2, which were generally conducted in secondary, tertiary or K–12 contexts, and provided nuances to these factors that were unique to the primary school environment. Despite some studies indicating that the devices themselves do not affect a teacher's ability to integrate technology (Hauge, 2014; Tallvid, 2016), it is clear that access to technology remains an issue in the modern primary school. These issues of technology access affected the mentees' teaching and learning activities, and caused interruptions to the flow of lessons. However, the issue of access to technology needs to be considered in all its forms, particularly those of availability and reliability of both the technology and the structures that support it. These structures include the protocols and policies surrounding the use and sharing of devices. There were also problems with accessing appropriate and functional software in several of the schools, which were mitigated, at least to some extent, by the advice from the mentors and the abilities of the mentees. Other factors that impacted on primary teachers' abilities to successfully integrate technology included their attitudes to productive technology use, and teachers' and students' expertise when using the technologies.

In particular, the educational system and school leadership greatly affected teachers' abilities to integrate technology. System and school leadership can resolve issues of availability and access, such as those mentioned above, by establishing appropriate policies and procuring additional devices. Similarly, for teachers to successfully access the available devices for teaching and learning, leaders need to establish and foster a supportive culture of technology integration. With regard to the second research question, leadership support also facilitated the participants' engagement with the professional learning. This took the form of both direct support and the allocation of additional time, which was commonly mentioned as essential by the participants.

As a result of the professional learning at each school, each mentee demonstrated growth, and all mentors and mentees but Sarah were confident to mentor others in the area of integrating technologies. As the mentees became more skilled and confident in integrating technologies in their teaching and learning programs, participants' reports of students' behaviours such as demonstrating independence and willingness to support their peers became more evident. While not all the mentees reported increased achievement of student outcomes, all of the mentees reported increased student engagement as a result of technology integration becoming more evident in their learning spaces. The literature reviewed in Chapter 2 suggested features of professional learning and mentoring that might yield more effective results. The study in this thesis found that some of these features, including the need for a strong mentor-mentee relationship, an appropriate mentor and the participants' positive attitudes towards the learning, facilitated the mentees' engagement with the professional learning in this study.

In addressing the third research question, this study found that the participants responded positively to the supporting templates and the framework. However, feedback and findings regarding the use of the toolkit suggested that refinements to the different elements of the toolkit should be made prior to its dissemination to a wider scope of schools. In particular, certain changes were necessary to the framework. These refinements are elaborated on in section 6.2. Other necessary changes, such as those to the mentoring structure and the supporting templates, are discussed under Key Implications 4 and 5 in section 6.3. Despite the need for these modifications, the value which the participants placed on the entire toolkit, as well as the evidence of mentee growth, suggest that this mentoring structure provides a sustainable and effective professional learning model for building teachers' capacity in integrating interactive technologies.

6.2 Refinements to the framework

As stated, the initial aim of this study was to provide schools with a toolkit to support professional learning in the integration of interactive technologies. The findings, as discussed in Chapter 5, showed that the professional learning model, the framework and the supporting templates addressed this intention, albeit with some modifications that need to be made in light of the findings. To ensure that there is something 'ready for use', the toolkit will be made available to schools and teachers upon the publication of this thesis. The toolkit will comprise:

- the background and context of this study
- the key findings that specifically relate to the implementation of the mentoring process, the framework and the supporting templates
- instructions for the application of the different components of the toolkit
- the final framework and supporting templates.

While having built this study's framework on four other integration frameworks, as described in section 3.4.1, the findings and feedback indicated that the new framework needed the majority of refinements, when compared to those needed for the rest of the toolkit. By refining it, this framework would mature into a more robust component of the toolkit, as well as a developmental framework for teachers seeking to explore technology integration in a scaffolded way. Therefore, refinements of the framework are presented first in this section, before discussing the minor changes to the whole toolkit and the supporting templates under Key Implications 4 and 5 in section 6.3.

Refinements to the framework were made in response to common participants' feedback, such as discussed in section 5.3.2, and to the findings regarding the implementation of the toolkit, as discussed under various sections in Chapter 5, such as in sections 5.2.2, 5.3.1 and 5.3.4. These findings and feedback have been collated into Table 6.1.

Table 6.1

Summary of findings and feedback relating to the framework

	Finding/Feedback	
Function	1.	The framework was frequently used by the mentors
	2.	The framework provided a good scaffold for learning
	3.	The framework can be used by different teachers
	4.	The framework requires clearer instructions on its use
	5.	Progression within the framework may not always be linear
Design	6.	Language of the framework needs to be simpler
	7.	The framework design needs to be attractive to and accessible by teachers
	8.	The use of the word 'stage' in the framework may confuse teachers

6.2.1 Changes made to the framework

As a result of the findings and the feedback listed in Table 6.1, changes have been made to the draft framework (Figure 3.2). Integrating these changes resulted in the revised framework, which can be seen in Figure 6.1 and at Appendix C within the toolkit. Descriptions of the changes are presented under two broad categories, textual and aesthetic changes, which also include a brief explanation on how the changes responded to the findings and feedback outlined in Table 6.1.

Text and language changes

Findings 3, 4, 5, 6, 7 and 8

To enhance clarity, the wording of each access point has been revised to improve tone and accessibility. In response to those findings relating to the language choice and tone (findings 3, 6, 7 and 8) and to ensure that the framework remains easy-to-follow (Table 4.2.4), the following changes have been implemented:

- **Each access point begins with the person or the item it targets.**
  As seen in Figure 6.1, most access points now begin with the word ‘teacher’, indicating that the teacher should be exhibiting the behaviour described. Other access points may indicate student behaviour, lesson design or a particular resource.
- **Language choice has been simplified and made more explicit.**
  The access points have been altered to ensure that they are more explicit. Where ambiguity may be unavoidable, examples have been included. The language has been simplified throughout the framework and written in plain English to ensure that it is more easily accessible. The word ‘stage’ has now been replaced with ‘phase’ to avoid the confusion discussed in finding 8. The titles of each phase have been replaced by words that are more accessible and which more closely reflect the access points in that phase. For example, ‘synergy’ has been replaced by ‘harmony’.

In response to findings 4 and 5, a brief introduction has been added with some instructions on how to use the framework. The addition means that there are some instructions readily available when using the framework on its own. Though these instructions are brief, it is assumed that they will be used, at least initially, in conjunction with the more comprehensive instructions in the toolkit (Appendix C). This instruction also includes a statement about how a teacher's skill may move up and down on the framework, depending on their confidence with a particular technology or curriculum.

Aesthetic changes

Findings 1, 2 and 7

A comparison of the draft framework used in this study (Figure 3.2) and the final version (Figure 6.1) shows changes to the aesthetic design of the framework. Considering that the draft framework (Figure 3.2) already provided a good scaffold for teachers' integration skills (finding 2), changes were made to improve the accessibility and readability of the framework, including delineating the domains and phases through the use of colour, and changing the text font type and size. Other aesthetic changes have been implemented to create a more attractive and professional look.

Interactive Technologies Integration Framework

This framework provides an evidence-based model for successful technology integration into the curriculum. While the framework is progressive, a teacher's skill may shift up and down the framework based on their confidence with a particular technology or curriculum. This framework allows a teacher to identify their current level and then identify further skills they would like to achieve.

	Phase 1 Replacement	**Phase 2** Supported	**Phase 3** Interactive	**Phase 4** Blended	**Phase 5** Harmony
File Management and Operating System Use (OS)	Teacher uses digital technology in some way (administrative, or teaching and learning). (OS1a) Teacher finds and uses digital files and software. (OS1b)	Teacher uses a digital resource that has been made by somebody else for teaching and learning. This may include premade lessons. Lessons progress linearly, rather than moving between the different components of a lesson. The teacher does not deviate from the premade lesson. (OS2a) Teacher finds references, materials and other supporting documents from other sources, e.g. shared resources on the server, the internet or similar repositories. (OS2b)	Teacher is able to multitask, i.e. flip between different software, websites and other resources, to support teaching and learning. (OS3a) Teacher is familiar with premade teaching content and, as such, lesson pace is improved. This includes retrieving a range of information and support materials with ease. (OS3b)	Teacher and students share resources, e.g. collective media files, pictures, information. (OS4a) Teacher provides opportunities for students to share learning with authentic audiences (e.g. email to teacher/s for review, present to class or school, video conference outside the school environment, collaborative blogging). (OS4b)	Teacher and students share ownership of all ICT within all learning spaces. Choice of technology facilitates learning and teaching, and can be made by both teacher and students. (OS5a) Teacher and students share expertise, mentoring each other on the use of digital technologies to enhance learning. (OS5b)
Mechanical Skills (MS)	Teacher uses devices as presentation tools, such as projecting onto an interactive whiteboard or television. (MS1a) Teacher saves files created in lessons, but these files are not referred to in later lessons (i.e. lessons are treated separately and not related). (MS1b)	Students use devices to word process/write, highlight or drag. (MS2a) Third-party software is used in a limited manner for teaching and learning, e.g. free use of *Reading Eggs*; whole class activity only on *Mathletics*. (MS2b) Lesson design uses images and resources to support the learning, rather than using them as core components of the lesson. (MS2c)	Students use digital technologies to assist with conceptual learning across learning areas. (MS3a) Teacher uses a wider range of resources (including Internet, cameras, robotics kit) to promote the learning of the curriculum and not for decoration or play. (MS3b) Teachers share with each other their lesson ideas, media and resources. (MS3c) Premade and saved documents are used as a continuation of prior learning, and may be referred to in current and future learning opportunities. (MS3d)	Students' confidence and regular use of technologies reflect the increased teacher confidence in technology integration. (MS4a) A number of technologies, and the extent of their functions, are integrated into the curriculum during a single lesson. (MS4b) Learning is open-ended and technologies are used to explore the direction that the learning is taking. (MS4c)	Teacher and students are confident in using a variety of technologies together. (MS5a) Teacher and students experiment with the different functions of current and emerging technologies together. (MS5b)

Figure 6.1. The revised framework

Program Variables (PV)	Lesson includes basic tools or devices, e.g. camera on an iPad. However, the use of these tools is not integrative and does not add to the teaching and learning experience, e.g. teacher records students' learning only to capture the activity. (PV1a)	Lessons include the use of the basic tools (as in PV1a), but the use of the tools is now more integrative and enhances learning (e.g. students are recording themselves on the iPad for retelling; teacher records students' learning for assessment and reporting purposes). (PV2a)	Teacher takes opportunity to use different functions of technologies experimentally and with increasing confidence, to support the teaching and learning of the curriculum. (PV3a)	Teachers across networks (i.e. outside the school) collaboratively share complex resources. There is evidence of joint development of resources across networks. (PV4a) Teacher develops strategies to improve lesson pace and flow by using technologies. (PV4b)	Students and teachers use technologies to allow for authentic audiences and collaborative learning in the learning space. Collaborative projects play a significant part in students' learning, which may include projects across groups, schools and countries. Students and teachers seek information from a variety of sources around the world, including experts in fields. (PV5a) Students and teachers use technologies with the global learning community to share, respond and add to students' learning experiences. Students' learning is a shared responsibility. (PV5b)
Classroom Management and Pedagogy (CMP)	Teacher is the sole user of any digital technology in the learning space. (CMP1a) Lessons with technology are paced identically to those without. (CMP1b) Teacher presents information, and students respond to questioning by teacher using the initiate-response-feedback model. (CMP1c) Technology is used as a reward for core learning. (CMP1d)	Students' use of devices is strictly planned by the teacher and is restricted to technical features such as drag and reveal. (CMP2a) Technology use is most commonly found in teaching those subjects that naturally allow for technology inclusion, e.g. English, rather than dance. (CMP2b) Teacher uses the metalanguage of technology. (CMP2c) Technology use in learning spaces supports teacher-directed and -centred learning. (CMP2d)	Teacher initiates and plans opportunities for students to select technology. (CMP3a) Teacher includes the use of technologies in a growing range of subject areas. (CMP3b) The use of digital technologies is increasingly spontaneous and is used in response to learning, e.g. directing students to answer spontaneous questions using a technology. (CMP3c) Teacher experiments with blending technologies to differentiate learning, and to support students' development of a deeper knowledge and understanding of the curriculum, including literacy and numeracy skills. (CMP3d)	Lessons using technologies have an emphasis on the curriculum, rather than the functions of the technologies, e.g. a lesson on developing a video narrative focuses on aspects of good storytelling, rather than on operating the video recording device. (CMP4a) Technology use in teaching and learning sustains dialogue, and affords students opportunities to demonstrate their learning. (CMP4b) Teacher uses online communities of practice to improve pedagogy and get teaching ideas. (CMP4c)	Teacher demonstrates an intuitive interaction with technologies, resulting in less rigid lesson structures and designs that include learning differentiation and assessments. (CMP5a) Teacher and students have equal say in dictating the direction, momentum and scale of the lesson. (CMP5b) Teacher reflects on their practices using technologies. (CMP5c) Teachers and content experts work collaboratively to share ideas, review lessons and develop new learning that synergistically blends a variety of resources, assessments and activities. These learning experiences emphasise the use of digital technologies in innovative and creative ways. (CMP5d)

6.3 Key Implications

The key implications of the study were formulated from the prominent findings that emerged. In line with a constructivist approach to knowledge, most of the key implications reported below refer to previous relevant research and explain how the findings from the study reported in this thesis have added to knowledge in those areas. For each of the key implications, a statement describing the implication is presented first, followed by a summary of the findings from the study that support each statement. Following the discussion of the key implications, recommendations for future studies are suggested.

Key Implication 1: Technology access in primary schools is a complex issue that goes beyond just availability.

> *There remain issues with technology access in schools. However, suitable access to technology needs to go beyond having access to many or even different technologies. While teachers and students need access to appropriate and reliable technologies in their teaching and learning, school infrastructure, and school- and sector- based systems, such as supportive policies, need to be available to enable the use of such technologies.*

In addition to this study, many technology integration studies in schools have been conducted. Findings from several of these studies, such as in Tallvid (2016) and Hauge (2014), have shown that teachers' use of technology presents a more significant issue than having access to the technology itself. Despite these findings, other studies such as Harriman et al. (2016), still found issues relating to the availability and reliability of technologies. The study reported in this thesis found, in particular, that successful technology integration is not a black and white issue and cannot be split so easily into the two factors described by the cited literature, that it is reliant entirely on either better access to technology or the teachers' use of such technologies.

Certainly, teachers' skills and attitudes influence the use of technology in schools, as seen in Van Rooy's (2012) study with secondary biology teachers, and it was partly on the basis of this premise that the study described in this thesis was designed and implemented. The study reported in this thesis found that teachers' skills and the mentoring advice given to mentees assisted the primary teachers in mitigating the limitations of their available technologies. However, it remained clear that issues arising from technology availability, reliability and infrastructure continued to impact on the teachers' ability to successfully use and integrate technology, as suggested by the *ICT in Schools for Teaching and Learning* audit (Audit office of New South Wales, 2017).

Although technology availability remained an issue, this study showed that it was not the most critical for primary schools. Ultimately from this study, technology availability was only revealed as a limitation at one school – Hunter Primary School, which they remedied by procuring new iPads. River Primary School did not have any availability problems, as they implemented a BYOD policy for their Years 5 and 6 students. This school-based policy was supported systemically by an overarching departmental policy (DoE, 2013). Apart from remedying device availability issues, the use of home devices for learning at school also ensured that students understand that their devices can be used for the purpose of productivity rather than simply entertainment, a factor suggested as necessary by the recent report of the 2017 NAP-ICTL test (ACARA, 2018a). Despite this increased availability and access at River Primary School, the BYOD solution was not without flaws. At this school, software limitations caused problems for Kelly and her students, such as where students had differing access to software functions due to the variety of devices in the class.

Although device accessibility did not present as an issue at River Primary School, it did present as a limitation in the other schools. Issues concerning reliable technologies remained at Ridge Primary School, where the laptops often failed. Problems with the reliability of infrastructure, such as access to the school network and internet, were seen at Ridge and Edge Primary Schools. The class at Edge Primary School found that their iPads were not always ready for use, as they may not have been charged after previous use by another class. In all cases, these limitations, in different ways, affected lesson flow and the teachers' ability to integrate the technologies as intended. While Newhouse (2014) suggested this as an important factor for successful technology integration in secondary schools, the findings in this study showed that this factor was also important in the primary context.

To reduce the impact of these issues, the schools presented certain solutions, such as procuring more devices and implementing school policies. These solutions, however, rely on educational system and school leadership to resolve the issue of access, as seen under Key Implication 2.

Key Implication 2: Leadership support is a critical factor in the successful integration of technology and in the engagement with professional learning.

> *Leadership support is required in a variety of areas to enable teachers' integration of technology. Firstly, as presented in the previous key implication, support is required to gain access to reliable technology. Secondly, leaders need to imbue schools with a supportive culture of technology integration and, thirdly, they need to support teachers in accessing relevant professional learning in this area.*

In this study, school culture played a part in determining successful technology use. Angela felt pressure from other Kindergarten teachers to reduce technology integration into her teaching and learning programs. She felt she was not able to fully explore the potential of her available technologies. At the same school, Rob stated that many teachers lacked enthusiasm for using technology in teaching and learning. As school leadership affects the culture in a school community (Hardy et al., 2017), support from leaders is, therefore, necessary in primary schools, including those in this study, to encourage whole school adoption and integration of technology into their operations. Similarly, large-scale decisions require the actions of school leaders, including the adoption of technology-related policies and school strategic directions, as suggested by Sarah from Edge Primary School.

The directions determined by school leaders affect other aspects of school life for teachers. Apropos of school culture, teacher and leader development are essential elements which require school leadership support. This study and others, such as those conducted by AITSL (2014), present findings that support more effective professional learning methods than the one-off courses that teachers traditionally attend. Mentoring forms of professional learning were highly regarded by the participants in studies by Albion et al. (2015), Aubusson et al. (2015) and Goddard et al. (2014). Similarly, the primary teachers in this study found value in engaging with this study’s mentoring structure and compared it positively in the survey to their attendance at courses.

Reduced, or a lack of, leadership support resulted in difficulties for the teachers in maintaining engagement with the professional learning in this study. The findings from Ridge Primary School showed a stark contrast between the period of leadership support and the time when this support was not available. After the deputy principal left, the teachers could no longer engage with the learning, which may have impacted on the effectiveness of the professional learning at this school. Tableland Primary School was not able to engage with the study at all, because certain constraints in their school timetable and student support mechanisms did not allow the mentor to observe his mentee's lessons.

In all cases, the participants expressed the need for additional time to engage with the professional learning. Rob, Andrew and Jennifer, the mentors from Hunter, River and Edge Primary Schools, all used their own release from face-to-face teaching and personal time to accommodate the mentoring, and all expressed that this was not preferable.

This study showed the importance of leadership direction in ensuring that schools support teachers to make pedagogical choices for integrating technology, both through access to the technologies and in terms of school culture. Also, leadership support is required to allow teachers to engage with relevant and valued professional learning, thereby allowing teachers to build the necessary skills to increase the effectiveness of technology use for teaching and learning.

Key Implication 3: The successful implementation of the professional learning model requires a strong mentor-mentee relationship, a carefully selected mentor, and positive mentee attitudes and value for the professional learning.

> *The effectiveness of the study's mentoring approach relied on a number of factors. A positive and strong mentor-mentee relationship supports the collaboration and the interactions necessary for an effective mentoring process. To facilitate this relationship, there should be a mentor who has both a foundation of expertise in mentoring and in the content area. This mentor must also personally value and have commitment to grow in both areas. Similarly, the mentee must also value the professional learning in which they are engaged and, therefore, demonstrate a commitment for their own personal development.*

Hudson and Hudson (2016) suggested a need for a strong mentor-mentee relationship in their study. In the same way, this need defined the effectiveness of the mentoring partnerships in the study reported in this thesis. Those primary schools with more developed relationships, especially those that were already established (e.g., Rob/Angela; Andrew/Kelly), were more likely to present features of successful mentoring and professional learning (as described in studies such as Hardy et al., 2017; Kemmis, 2006, 2009, 2010; Reason & Bradbury, 2001). These features included: a more collaborative dynamic; a more even balance of power between the mentor and the mentee; opportunities for the mentee to self-assess and reflect on their own development, and opportunities for the mentor to tailor the learning to the mentee. The cases with more developed relationships also revealed more evidence of the mentor providing support, encouragement and positive feedback. The only exception was Jennifer and Debbie's relationship, which Jennifer reported as a relationship that was established at the beginning of their mentoring process. While this did not appear to have impacted on the effectiveness of the professional learning, the interactions between Jennifer and Debbie were more mentor-led, and resulted in less collaboration and less evidence of Debbie self-assessing and monitoring her own development.

To facilitate the mentoring relationship, a strong mentor, with both substantial mentoring skills and content knowledge, was required. Similar to suggestions made by Kraft et al. (2016), who explained that the quality of mentoring is more important than other factors, the study reported in this thesis revealed that mentoring expertise was more important than content expertise in promoting effective professional learning. Skilled mentors were able to engage a variety of mentoring techniques and strategies in order to facilitate mentee growth across the primary schools. The necessity for mentoring expertise was particularly obvious with Sarah from Edge Primary School, who continually professed a lack of expertise in integrating technology, but who had experience in mentoring and had an existing mentoring relationship with Debbie. Despite this unique scenario, a balance of mentoring and content expertise remained important in facilitating the professional learning, as seen in the other schools.

Other studies, such as those by Garbacz et al. (2015), and Hudson and Hudson (2016), showed that there was a need to develop the mentor. This need was reflected in this study's findings and participants' feedback. In the same way, the difference in the mentors' skills in this study supported the fact that mentors would benefit from support and development opportunities in both mentoring and the content area. This was particularly obvious in Sarah's suggestions for her to be supported and developed in integrating technologies into teaching and learning.

The mentees were committed to engaging in the mentoring process, as reported by the mentors in Table 5.4. As indicated by Maor and McConney's (2015) study, the fact that all mentee participants grew in their integration expertise suggests a probable link between the success of the professional learning, and the mentees' interactions with and commitment to the learning.

Key Implication 4: The toolkit developed from this study provided an effective mentoring structure that support professional learning in technology integration.

> *The mentoring structure used in this study was found to support the mentors' ability to guide and facilitate mentee growth. However, the findings showed that elements of the toolkit needed refining. Specifically, the mentoring structure needs to accommodate more natural engagement with the learning, and include explicit instructions on how to implement the professional learning model, the framework and the supporting templates. The following presents a more detailed description of the necessary refinements, which have been incorporated into the final toolkit (Appendix C).*

The findings from the study showed a need to remove certain restrictions and processes for the study from the toolkit, such as the limited six-week duration (as will be discussed under Key Implication 5) and the data-gathering processes. While elements of the data gathering are still required to monitor growth, this process should be more natural and acclimatised to the context in which the mentoring is applied. As briefly mentioned in section 6.2, minor changes have been made to the templates to reflect the changes made to the framework, including the removal of any reference to the data-gathering processes for this study. With the new understanding that teachers' skill building is not linear or necessarily progressive, the Recording Tool should not be deemed as an essential part of the toolkit. Rather, as with the Review Form, this template should offer a non-essential support mechanism for mentors to use. Similarly, while the Field Notes Template was more widely used, the fact that two mentors did not use it suggests that this was also non-essential. The use, or lack of use, did not appear to affect the effectiveness of the mentoring. Descriptions of how these templates can support the professional learning model have been added to the instructions within the toolkit.

Some changes and additions were necessary to incorporate other findings and feedback relating to the toolkit. First, the process itself appeared to require more explicit instructions. The pre-study meeting was essential. It provided a necessary foundation for the participants to grasp the nature of the mentoring structure and the data-gathering processes. Problems occurred in the first pre-study meeting at Ridge Primary School, where a second meeting needed to be scheduled to clarify the process, and with David at River Primary School, where he did not engage with a pre-study meeting. David's lack of engagement with the instructions resulted in confusion around the use of the framework and the templates. Therefore, in developing the final toolkit, a set of explicit instructions for the templates is included in the toolkit, as mentioned above, and for the application of the mentoring process.

These instructions were developed from those provided during the pre-study meeting, and were then expanded, made clearer and more explicit. Aligning with the improvement to the framework, these instructions were designed to be more accessible to teachers.

As with the changes made to the framework, a brief introduction has been added to each template. These introductions, as with the one in the framework, are brief and are expected to be used, at least initially, in conjunction with the more comprehensive instructions in the toolkit.

Since the refinements to the toolkit, another review process has already been conducted. The penultimate version of the toolkit was distributed to both primary and secondary teachers. Their feedback on the toolkit was positive and their suggestions have been integrated into the final version of the toolkit seen at Appendix C.

Key Implication 5: The mentoring process should continue longer than the six-week duration that was previously prescribed for the study.

> *It is necessary to emphasise that the variation in the schools' engagement with and the findings relating to the professional learning model suggest that engagement with the model beyond the six weeks would be beneficial.*

Various findings suggest that the requirement for a six-week study may not have been as conducive as possible to the professional development of the mentees. Contrary to suggestions from other studies (e.g., Ernst & Erickson, 2018; Whitworth & Chiu, 2015), the professional learning model from the study reported in this thesis was often not prolonged, ongoing or continuous. All but one of the schools were not able to fully engage with the prescribed six weeks. This was not by design, but rather resulted from features and factors specific to these primary schools, such as a change to leadership support at Ridge Primary School, and problems emerging from a combination of personal factors and teachers' responsibilities at Tableland Primary

School. Despite the inability of most schools to complete the full six weeks process, the findings from the study showed that an ongoing and continuous mentoring process was preferred by nearly all of the participants, who reported that they will continue to work with their mentoring partners (as discussed in section 5.3.3). Removing the restrictions of this study's timeframe and for six weeks of engagement would have allowed schools to overcome these issues. For example, Tableland Primary School might have been able to begin their engagement with the professional learning at a later date, once the mentees had caught up with their professional responsibilities and considered strategies to enable Stuart to observe the lessons.

Problems arising from this study's particular mentoring and action research model might also have been mitigated by longer exposure to the professional learning. The mentor-mentee relationship at Ridge Primary School was weaker during the first two cycles when compared with the relationship evident from their third cycle. It seems likely that should this mentoring process have continued, the mentor-mentee relationship would have continued to grow, with the possibility of greater mentoring effectiveness. This suggestion is supported by evidence from the same school, where a change in the mentoring effectiveness was seen by the third cycle. During the third cycle, there was evidence of more collaboration and increased support from Allan. Similarly, a longer exposure might also build areas of trust and rapport, between the mentors and the mentees. The added trust and rapport might overcome the stigma of lesson observations, as hypothesised in section 5.1.3, and issues relating to a change in mentors, as suggested by Kelly (Table 4.3.4).

6.4 Limitations of the study and implications for future studies

In Chapter 5, possibilities for future studies emerged from the findings as areas of interest that could be further explored, and from the limitations of the study that were identified. These possibilities and limitations are highlighted below along with aspects of the study that support further investigation.

Mentor motivation, benefits and change

Four mentors revealed both altruistic and personal motivation for participating in this study's professional learning. However, there was no evidence for the other three mentors' motivations for participation. For this reason, it was difficult to align mentee growth to mentor motivation. A more focused study in the area of mentor motivation would allow any statements regarding this to be made more definitively.

Elements of the study revealed that mentors benefited from their participation, similar to the experiences reported by Hudson and Hudson (2016). The study presented in this thesis also suggested that mentor benefits varied, based on the extent of their investment with the process. As seen in section 5.2.2, the mentors reported that they developed new knowledge and skills as part of their participation in the process. It was, however, shown that Allan reported the fewest mentor benefits compared to the other mentors. It was hypothesised that Allan's mentoring ability, the strength of the mentor-mentee relationship between Allan and Sally, and the duration of their engagement with the professional learning may have affected the amount of benefits Allan perceived during this process. However, as this study was not designed to examine mentor benefits in detail, this area, including the factors impacting on mentor benefits, present as an area for further study.

Changing to a different mentor during the process appeared to have impacted on the attitudes of the mentees, especially Kelly. The findings from the case studies suggest that strategies, such as more prolonged exposure to the different mentors (Key Implication 5), might mitigate issues arising from the mentor changes. This suggests that a study designed to examine the impact of these strategies, and the results and impact of mentor changes would be beneficial.

Curriculum

Another possible area of investigation was the influence of curriculum on the integration of technology. In this study, the mentees engaged in teaching curriculum from different learning areas, such as seen in Table 5.3. While the choice of curriculum did not appear to have impacted on the mentees' ability to integrate technologies into these curricula, the limited data available from this study relating to this topic does not allow this statement to be definitively made. To more confidently make this claim, further study in this area would be needed, with more case studies across multiple curriculum areas.

Mentee expertise, attitudes and beliefs

Although other studies reviewed in Chapter 2, such as Ertmer and Ottenbreit-Leftwich (2013), and Hramiak and Boulton (2013), explored more deeply the factors of teacher expertise, attitudes and beliefs, and their impact on teacher growth and the integration of technology, this study did not investigate these factors in detail. Exploring these areas and their effects would provide more evidence of their impact on the professional learning model, and might suggest solutions to accommodate or integrate these areas in order to strengthen the professional learning approach. Also, there are opportunities to explore how engaging in the professional learning model, and using the toolkit, may affect the value the teachers place on the use of ICT in teaching and learning.

Scope and scale

A prominent limitation of this study was its scale, as is common with case study approaches. While the intention, as explained in section 3.3.3, was to engage with a more diverse group of schools, ultimately the study was only able to engage with government schools in NSW. It is therefore unclear whether the findings can be extrapolated to all contexts, and there is perhaps a possibility that the toolkit may not be as effective in every unique context and school. While the five schools included features common to many of the schools in NSW and beyond, care needs to be taken in making any assumptions relating to the toolkit's appropriateness in all school contexts. This limitation means that the small-scale case study approach used here should not be used as a basis for generalisation (Mattsson & Kemmis, 2007; Shulman, 1986). Therefore, to be able to more definitively state that this mentoring structure will be an effective model for a wider category of schools, future testing of this structure in a larger and more varied sample of primary schools would be preferable. Additionally, the value participants held for this approach of mentoring suggests that adjustments could be made to the structure to implement this approach in secondary and tertiary settings. This would require further necessary testing of this professional learning model in those settings.

A concern relating to the diversity of the sample is the applicability of the mentoring structure to small schools. In particular access to appropriate mentors could be problematic for small schools, especially those in remote areas with only one teacher. Testing this mentoring structure in a community of schools, as opposed to within one school, would provide an opportunity to examine how the mentoring would apply when the mentor might not have a comprehensive knowledge of or share similar goals regarding the mentee's context. Another element to examine would be remote mentoring. AITSL (2014) and Kraft et al. (2016) explained that remote professional learning may overcome issues relating to distance, and increase scope and scale. This is especially pertinent when studies, such as Broadley (2010), highlight the difficulties for rural and remote teachers in accessing relevant and meaningful professional learning.

In an effort to reach a larger number of schools, a blended learning environment, which combines face-to-face learning with online modules, might also offer a solution. Online preparation prior to the face-to-face component might allow participants to engage with deeper and richer discussions (Hardin & Koppenhaver, 2016). Additionally, Hardin and Koppenhaver (2016) found that participants in their study were able to progress through the online modules at their own pace. Augmenting and studying the implementation of the mentoring structure in a blended learning environment would provide more insight into how to support a larger number of schools.

Alternatively, rather than reaching a larger number of schools, a whole-school approach, where every teacher is either a mentor or a mentee, presents as a potential area for exploration. A study of this approach may ascertain the impact on whole-school change, as well as factors that would influence the implementation of this study's mentoring model across the school.

Alternate delivery of the framework

There is an opportunity to expand the framework by presenting the descriptors for the access points in different ways, and providing greater detail on how to interpret and implement the framework. This is particularly pertinent since it was hypothesised that Kelly's two mentors may have interpreted the framework differently (section 5.3.1). The participants at Ridge Primary School, as seen in Table 4.1.4, suggested that indicators and scenarios providing examples of the different skills in the framework might improve teacher interpretation of the framework. This level of detail suggests that a digital platform, where the examples could be presented in text and in multimedia formats, would facilitate the framework's delivery. This would make the examples, and therefore the framework, more accessible to teachers. This development would then need further user testing to gather the necessary feedback to ensure its effectiveness.

Future studies

It is anticipated that further research in the areas of mentoring, professional learning and technology integration will continue to be conducted by other researchers. To ensure that the framework and the professional learning model remain relevant in the future, new research should be used as a basis for further development of the professional learning model and the framework.

6.5 Final reflections

The undertaking of this study has both confirmed and questioned the assumptions that I initially held about the complex topic of integrating technology in primary schools. As a primary school teacher and now a leader in school education, I was often frustrated that barriers to the integration of technology resulted in technologies being used less effectively in schools. Interactions with many colleagues also strengthened these assumptions, some of which have not been supported by this study. My journey in this study revealed the vast complexities of this area in schools and my perception has now been broadened. I am committed to reflecting on and considering more deeply how these complexities affect technology integration. As the implications for future study have suggested, I feel that I have only scratched the surface of these complexities and, as I engage in further studies, other areas will emerge for future exploration.

This study has also sparked an interest in professional learning and the ways in which we can better support teachers to develop capacity in all areas, not just in the integration of technology. As I progress through different roles during my career, I will have further opportunities to work with teachers to develop different areas of pedagogy, student wellbeing, curriculum delivery and other aspects of school education. Exploring effective andragogy strategies and approaches will strengthen my practice, and make me a more effective leader in education. This study has provided an effective framework and structure for this process.

The aim for this study was always to contribute to the greater effort of bridging research and praxis, by using available research and the emerging findings from this study, to inform teacher practice. It explored the research underpinning technology integration and professional learning, and provided a plausible solution to build teacher capacity in integrating technology. This contribution responded to the need for more localised professional learning opportunities, as identified originally in Chapter 1. The results of this study show that there is value in this mentoring approach, and that future study and development of this professional learning model and framework are worthwhile. As there is already evidence that the participants were eager to continue the mentoring and using the framework, I hope that other schools will use the refined version of the toolkit and that this study will establish a foundation which encourages schools and systems to explore different ways to support effective technology integration in primary schools.

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APPENDICES

In order to accommodate the formatting of the main part of the thesis, and the intention to print and bind this thesis, the following alterations to the appendices were made. All appendices have:

- been reduced in size to fit onto the page
- converted to a monochromatic version, except for Appendix C – The Integrating Interactive Technologies Toolkit, where it is necessary to keep the colour.

Also note that:

- Appendix C and G follow their own page numbering. This is due to the fact that these are separate full-sized documents.
- The HREC approval (Appendix A), and the SERAP approval and its extension (Appendix B) refer to previously conceived titles of the same study.

Appendix A: HREC approval

Social Science Ethics Officer
Private Bag 01 Hobart
Tasmania 7001 Australia
Tel: (03) 6226 2763
Fax: (03) 6226 7148
Katherine.Shaw@utas.edu.au

HUMAN RESEARCH ETHICS COMMITTEE (TASMANIA) NETWORK

UTAS

17 June 2016

Dr Tracey Muir
Faculty of Education
University of Tasmania

Student Researcher: Perry Wong

Sent via email

Dear Dr Muir

Re: FULL ETHICS APPLICATION APPROVAL
Ethics Ref: **H0015523 - Integrating Interactive Technologies in Classrooms: A practical approach**

We are pleased to advise that the Tasmania Social Sciences Human Research Ethics Committee approved the above project on 9 June 2016.

This approval constitutes ethical clearance by the Tasmania Social Sciences Human Research Ethics Committee. The decision and authority to commence the associated research may be dependent on factors beyond the remit of the ethics review process. For example, your research may need ethics clearance from other organisations or review by your research governance coordinator or Head of Department. It is your responsibility to find out if the approval of other bodies or authorities is required. It is recommended that the proposed research should not commence until you have satisfied these requirements.

Please note that this approval is for four years and is conditional upon receipt of an annual Progress Report. Ethics approval for this project will lapse if a Progress Report is not submitted.

The following conditions apply to this approval. Failure to abide by these conditions may result in suspension or discontinuation of approval.

1. It is the responsibility of the Chief Investigator to ensure that all investigators are aware of the terms of approval, to ensure the project is conducted as approved by the Ethics Committee, and to notify the Committee if any investigators are added to, or cease involvement with, the project.

A PARTNERSHIP PROGRAM IN CONJUNCTION WITH THE DEPARTMENT OF HEALTH AND HUMAN SERVICES

2. Complaints: If any complaints are received or ethical issues arise during the course of the project, investigators should advise the Executive Officer of the Ethics Committee on 03 6226 7479 or human.ethics@utas.edu.au.

3. Incidents or adverse effects: Investigators should notify the Ethics Committee immediately of any serious or unexpected adverse effects on participants or unforeseen events affecting the ethical acceptability of the project.

4. Amendments to Project: Modifications to the project must not proceed until approval is obtained from the Ethics Committee. Please submit an Amendment Form (available on our website) to notify the Ethics Committee of the proposed modifications.

5. Annual Report: Continued approval for this project is dependent on the submission of a Progress Report by the anniversary date of your approval. You will be sent a courtesy reminder closer to this date. **Failure to submit a Progress Report will mean that ethics approval for this project will lapse.**

6. Final Report: A Final Report and a copy of any published material arising from the project, either in full or abstract, must be provided at the end of the project.

Yours sincerely

Katherine Shaw
Executive Officer
Tasmania Social Sciences HREC

A PARTNERSHIP PROGRAM IN CONJUNCTION WITH THE DEPARTMENT OF HEALTH AND HUMAN SERVICES

Appendix B: SERAP approval

Education
Public Schools

Mr Perry Wong

DOC16/732796
SERAP 2015377

Dear Perry

I refer to your application to conduct a research project in NSW government schools entitled Improving technology integration in primary schools: a practical approach. I am pleased to inform you that your application has been approved.

You may contact principals of the nominated schools to seek their participation. You should include a copy of this letter with the documents you send to principals.

This approval will remain valid until 03-Aug-2017.

The following researchers or research assistants have fulfilled the Working with Children screening requirements to interact with or observe children for the purposes of this research for the period indicated:

Researcher name	WWCC	WWCC expires
Perry Wong	WWC0661667E	27-Mar-2020

I draw your attention to the following requirements for all researchers in NSW government schools:

- The privacy of participants is to be protected as per the NSW Privacy and Personal Information Protection Act 1998.
- School principals have the right to withdraw the school from the study at any time. The approval of the principal for the specific method of gathering information must also be sought.
- The privacy of the school and the students is to be protected.
- The participation of teachers and students must be voluntary and must be at the school's convenience.
- Any proposal to publish the outcomes of the study should be discussed with the research approvals officer before publication proceeds.
- All conditions attached to the approval must be complied with.

When your study is completed please email your report to: serap@det.nsw.edu.au
You may also be asked to present on the findings of your research.

I wish you every success with your research.

Yours sincerely

Dr Robert Stevens
Manager, Research
3 August 2016

School Policy and Information Management
NSW Department of Education
Level 1, 1 Oxford Street, Darlinghurst NSW 2010 – Locked Bag 53, Darlinghurst NSW 1300
Telephone: 02 9244 5060 – Email: serap@det.nsw.edu.au

NSW GOVERNMENT | Education
Public Schools

Mr Perry Wong

DOC17/566422
SERAP 2015377

Dear Mr Wong

I refer to your application for extension to the research project being conducted in NSW government schools entitled Improving technology integration in primary schools: a practical approach. I am pleased to inform you that your application has been approved.

This approval will remain valid until 31-Dec-2017.

The following researchers or research assistants have fulfilled the Working with Children screening requirements to interact with or observe children for the purposes of this research for the period indicated:

Researcher name	WWCC	WWCC expires
Perry Wong	WWC0661667E	27-Mar-2020

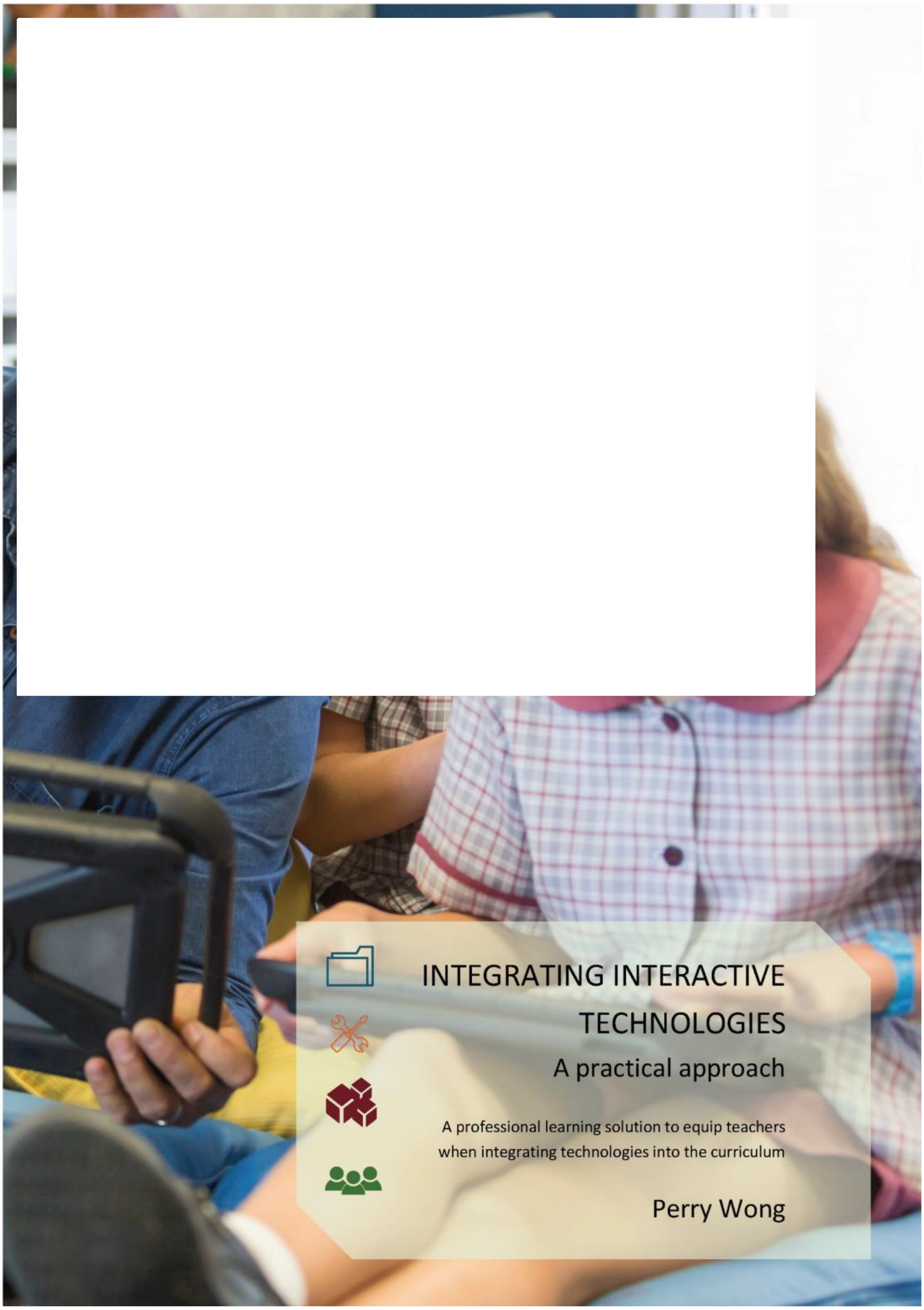
When your study is completed please email your report to serap@det.nsw.edu.au.

Yours sincerely

Liliana Ructtinger
Relieving Manager, Research
7 June 2017

School Policy and Information Management
NSW Department of Education
Level 1, 1 Oxford Street, Darlinghurst NSW 2010 – Locked Bag 53, Darlinghurst NSW 1300
Telephone: 02 9244 5060 – Email: serap@det.nsw.edu.au

Appendix C: Integrating Interactive Technologies Toolkit



Preamble

The toolkit presented here is the result of a detailed study of contemporary professional learning practice and incorporates a professional learning model, an information and communication technology (ICT) framework and supporting templates. The toolkit was tested in four different primary schools in NSW, Australia. In each primary school, two or more teachers (including at least one mentor and one mentee) engaged in a mentoring partnership, in which they collaboratively reflected on the mentee's practices and used the framework to identify milestones. The partners then negotiated appropriate strategies to achieve the identified milestones, using their own contextual knowledge and expertise. These were captured using the templates seen in this toolkit. Each school submitted data that revealed factors that influenced teachers in their ability to integrate technology; features of the mentoring model that facilitated the mentees' professional growth; and findings and feedback on this toolkit. The data were analysed individually for each school to identify unique factors, as well as collectively to reveal the common findings. The mentoring structure, the framework and the supporting templates were then refined, based on the findings from the study, resulting in the toolkit seen here.

The toolkit provides explicit directions for implementing a professional learning model for peer mentoring that takes advantage of the expertise within a school, as well as each teacher's deep knowledge and understanding of their own school context and situation. The framework provides participants with a learning scaffold, outlining the optimal level of technology integration, as defined by contemporary research, and the steps to reach this goal.

There is certainly no presumption that this toolkit is the only solution for building teacher capacity in technology integration into pedagogies and the curriculum. In fact, this toolkit is only one of many solutions available. Decisions about the appropriateness of the model and the framework for any specific context should be made after due consideration.

This toolkit provides an evidence-based solution for professional learning in the integration of digital and interactive technologies. The effectiveness of the toolkit is informed by evidence from the study that underpins it, and from the combined expertise of the developer, the participants of the study and those teachers, from both primary and secondary contexts, who were consulted after the initial refinement of this toolkit.

Ultimately, this toolkit was developed and tested by teachers for teachers.

NB: References to 'the study' within the toolkit imply the research study underpinning this toolkit.

Contents

What works and what doesn't?

When this toolkit was tested in schools, a number of factors emerged that improved the effectiveness of the implementation of the professional learning model. The following is a summary of these factors, which will assist you in making decisions about whether this learning model is the best solution for you and your school, and what structures can be implemented to improve the chances of success when it is implemented.

Technology access in schools

The importance of access to technology in schools has always been a matter of contention in schools and in the research. The study revealed that access remains an issue in schools, with certain complexities to consider, such as availability and reliability. The availability of devices is the most obvious area of concern for accessibility. The study also found that there were problems with the dependability of devices and the reliability of infrastructure. However, mentoring was found to assist in mitigating these issues in learning spaces. Therefore, a balance of reliable and available technology, with strong peer support will facilitate more effective integration of technologies into the curriculum.

School leadership

Appropriate school leadership can resolve the limitations with access to technology. The study found that issues of access were resolved when a school procured more technologies for one Foundation class. School leadership was also found to affect two other factors in the study – school culture and time.

School culture

School leadership support for technology integration has two main effects.
The support produces a culture that, in turn, supports technology integration, allowing teachers in the school to share their collective experiences and strategies for integrating technologies. Leadership support also encourages the participants of the professional learning to engage confidently with it.

Time

The learning model in this toolkit requires time. The mentor is required to observe the mentee at least once per cycle, then reflect with the mentee on the lesson observation, and negotiate appropriate milestones and strategies. While this may be done during or outside school hours, the study's participants preferred not to use personal or release from face-to-face teaching time. It is recommended that school leadership provide the necessary and additional time to facilitate the implementation of this learning model.

Commitment and motivation

All the participants in the study were volunteers and, therefore, were committed to engaging with the process. The findings from this study, which were consistent with those of other studies, showed that teachers who were motivated and committed to the professional learning process were more likely to show growth. It is recommended that this professional learning model be conducted only when both the mentor and mentee value this form of professional learning. The mentor should be committed to supporting the growth of their mentee, while the mentee should be an active participant in their own learning. This partnership should see the two teachers work collaboratively to reflect, identify milestones, and negotiate appropriate and relevant teaching strategies.

The 'right' mentor and a strong professional relationship

Mentor selection is key to successfully implementing this professional learning model. Although a mentor who is expert and confident in technology integration is ideal, the study found that mentors with more proficient mentoring skills increased the effectiveness of the professional learning. The study revealed that it is also advantageous for the mentor to engage in developmental activities, in both mentoring and in technology integration.

Consistent with other contemporary research, the study found that a strong mentor-mentee relationship enhances the level of professional trust, so that both participants are more open to engaging with the learning process. Those partners in the study with a stronger mentor-mentee relationship exhibited more features of effective mentoring and behaviours that facilitated effective professional learning.

Applying the toolkit

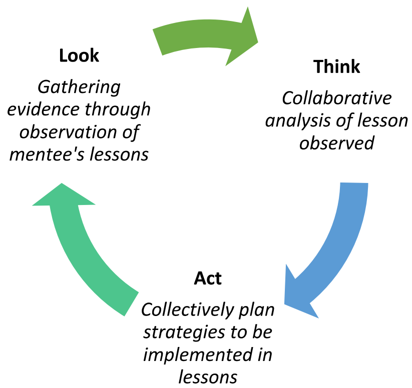
The strength of this professional learning model is in linking the right mentor with a motivated mentee and scaffolding the learning process. This section provides details for the learning process, including instructions for the mentoring structure, and descriptions of the framework and the supporting templates.

The mentoring structure

The mentoring structure adopts an action research approach, according to the following steps. The participants:

- observe and reflect on a lesson
- plan milestones for the mentee to achieve
- negotiate appropriate strategies to help the mentee achieve the milestones
- allow the mentee to practise these strategies.

This approach was adapted from the *Look, Think, Act* model by Stringer, Christensen and Baldwin (2010)[1], seen in the following derivative diagram.



Although the study restricted the participants to a six-week cycle, there is no such restriction on the timeframe for this professional learning model. In fact, it is encouraged that the cycle be continuous and that the teachers set up regular sessions. The literature review in the study found that the most effective professional learning is ongoing and continuous.

[1] Stringer, E. T., Christensen, L. M., & Baldwin, S. C. (2010). *Integrating Teaching, Learning, and Action Research: Enhancing Instruction in the K – 12 Classroom.* United States of America: SAGE Publications.

Benchmarking and review cycles

The process outlined in this type of cycle should be conducted during and after the first lesson observation, and periodically to ensure growth.

Prior to the lesson observation, the mentor is encouraged to have a clear understanding of the *Integrating Interactive Technologies Framework* (the framework) (pp. 8 - 9). This will allow them to have a clear idea of what to look for during the lesson observation.

The mentoring partners should schedule a time for a lesson observation that is both convenient to the mentor and which will cause the least imposition upon the mentee. The mentee is encouraged to present a lesson that not only showcases their skills, but also reflects the current curriculum priorities of the mentee and their class. It needs to be noted that these observations are not for any other purpose than to facilitate the mentee's growth. The mentor, therefore, needs to remember that their function while observing the lesson is to be supportive rather than judgemental.

During the lesson observation, the mentor looks for the behaviours described in the framework. If necessary, the mentor and mentee should decide on any supportive mechanism that may help with the reflection. This may include note taking or capturing the lesson through video recording. A suggested template for note taking is included in this toolkit (p. 11).

After the lesson observation, the mentor notes the date of achievement of any of the access points from the framework. A template is available for this purpose (p. 12). The mentor should advise the mentee of their achievement, and discuss the reasons for selecting those access points with the mentee. Collaboratively, the mentor and the mentee then reflect upon and discuss the observed lesson, engaging with the mentoring style that is most natural to the mentor. As a result of this reflection and discussion, milestones, which should reflect the access points in the framework, are decided for the mentee to achieve by the next lesson observation. It is recommended that no more than five milestones should be assigned, since too many milestones would be likely to cause difficulty with the process for the mentee. The number of milestones should be negotiated between the mentor and mentee to adjust for the mentee's capacity at that point in time, and it is not necessary for the participants to decide on exactly five milestones.

Once the milestones have been decided, the mentor should negotiate some practical strategies for the mentee to attempt before the next lesson observation. Both milestones and strategies should be noted down for easy referencing and record keeping. Again, a template can be found in the toolkit to support this process (p. 13).

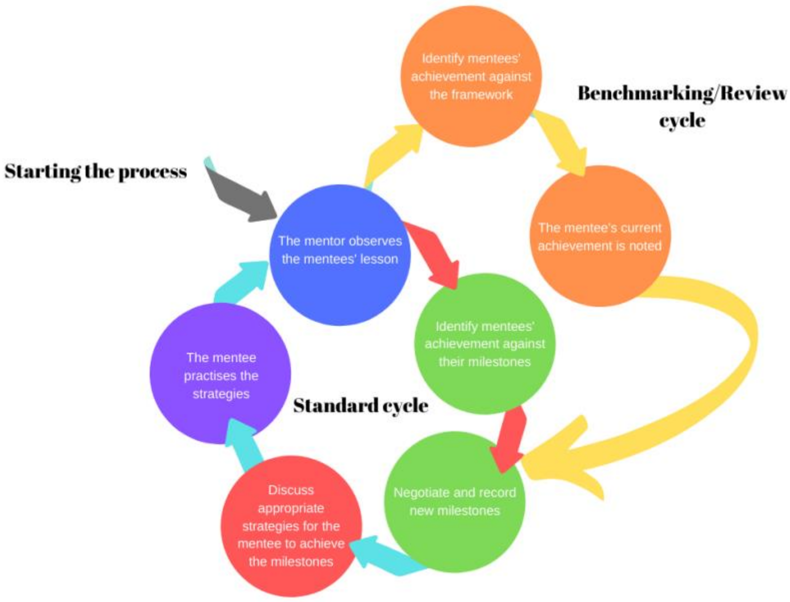
It is important to note that an effective mentoring structure relies on an even balance of power between the mentor and the mentee. The teachers should make an effort to ensure that both the mentor and mentee have an equal say in the decisions relating to the milestones and the strategies. The discussions should rely on both the mentor's expertise in the content and the mentee's extensive understanding of their own needs and those of their class.

It is recommended that a review cycle be conducted periodically so that the mentee's growth can be determined and to make any adjustments to the plan if necessary. In particular, a review cycle should be conducted when the mentee is attempting a new technology or is applying a familiar technology to new curriculum or theme.

Standard cycles

The standard cycles of this mentoring process are generally similar to the cycle described in the benchmarking and review cycles. The difference is that it is not necessary to mark the achievement of access points. The participants continue with the *Look, Think, Act* process.

The frequency for these cycles is negotiable. However, it is recommended that they are regular and that there is not a large amount of time in between each cycle. A lack of continuity may impact on the effectiveness of the process.



Adjustments

Every school is unique, as is every class. Therefore, the mentoring structure described above may require adjustment to work for each teacher. Each set of mentoring partners should make their own decision on whether to rigidly adhere to the structure or to make certain adjustments to accommodate their own context.

However, it is important to note that the design of the professional learning model and those factors outlined in *What works and what doesn't?* have been informed by both contemporary research in general and the findings that emerged from this study. Therefore, while adjustments are acceptable, it is not recommended that users of this toolkit deviate too far from the structure outlined in it.

Interactive Technologies Integration Framework

This framework was developed to provide a scaffold for teachers to measure their own skills in integrating digital technologies. This framework adopts some of the best features of four integration frameworks[2], and aligns with contemporary research on effective integration practices. It has been refined in light of the findings and feedback from the study, and then refined further from feedback from teacher reviewers.

The framework follows a similar structure to the two interactive whiteboard frameworks[2]. The framework splits integration skills into four domains: *File Management and Operating System Use, Mechanical Skills, Program Variables,* and *Classroom Management and Peda*gogy. There are five phases in the framework, progressing from basic skills outlined in Phase 1: Replacement to more advanced skills seen in Phase 5: Harmony. In each phase, access points to the skills are explicitly described and a shortened reference (e.g. OS2a), or identifier, is made against each access point for easy identification within the framework.

The access points describe either the expected teacher or student behaviour, or an element of lesson design. These access points should be used to determine a teacher's achievement, as well as the milestones for the next steps in a teacher's development. This sequence of steps should be determined after considering the teacher's current level of achievement and identifying where gaps may exist.

The study's findings showed teachers' skills on the framework do not necessarily progress in a linear way. Some of the study's participants achieved certain access points in one lesson, but then did not demonstrate the same skills in the subsequent lessons. It was hypothesised that teacher achievement against this framework might be affected when teachers use different technologies, or when they are teaching a different curriculum or theme. Therefore, reassessment of a teacher's ability against the framework, as in a review cycle, should be conducted when a teacher's context changes.

[2] The TPACK framework (Harris, Mishra & Koehler, 2009), the SAMR model (Puentedura, 2015), Transition Framework (Beauchamp, 2004) and Interactive Whiteboard Developmental Framework (Sweeney, 2008)

Interactive Technologies Integration Framework

This framework provides an evidence-based model for successful technology integration into the curriculum. While the framework is progressive, a teacher's skill may shift up and down the framework based on their confidence with a particular technology or curriculum. This framework allows a teacher to identify their current level and then identify further skills they would like to achieve.

	Phase 1 Replacement	**Phase 2** Supported	**Phase 3** Interactive	**Phase 4** Blended	**Phase 5** Harmony
File Management and Operating System Use (OS)	Teacher uses digital technology in some way (administrative, or teaching and learning). (OS1a) Teacher finds and uses digital files and software. (OS1b)	Teacher uses a digital resource that has been made by somebody else for teaching and learning. This may include premade lessons. Lessons progress linearly, rather than moving between the different components of a lesson. The teacher does not deviate from the premade lesson. (OS2a) Teacher finds references, materials and other supporting documents from other sources, e.g. shared resources on the server, the internet or similar repositories. (OS2b)	Teacher is able to multitask, i.e. flip between different software, websites and other resources, to support teaching and learning. (OS3a) Teacher is familiar with premade teaching content and, as such, lesson pace is improved. This includes retrieving a range of information and support materials with ease. (OS3b)	Teacher and students share resources, e.g. collective media files, pictures, information. (OS4a) Teacher provides opportunities for students to share learning with authentic audiences (e.g. email to teacher/s for review, present to class or school, video conference outside the school environment, collaborative blogging). (OS4b)	Teacher and students share ownership of all ICT within all learning spaces. Choice of technology facilitates learning and teaching, and can be made by both teacher and students. (OS5a) Teacher and students share expertise, mentoring each other on the use of digital technologies to enhance learning. (OS5b)
Mechanical Skills (MS)	Teacher uses devices as presentation tools, such as projecting onto an interactive whiteboard or television. (MS1a) Teacher saves files created in lessons, but these files are not referred to in later lessons (i.e. lessons are treated separately and not related). (MS1b)	Students use devices to word process/write, highlight or drag. (MS2a) Third-party software is used in a limited manner for teaching and learning, e.g. free use of *Reading Eggs*; whole class activity only on *Mathletics*. (MS2b) Lesson design uses images and resources to support the learning, rather than using them as core components of the lesson. (MS2c)	Students use digital technologies to assist with conceptual learning across learning areas. (MS3a) Teacher uses a wider range of resources (including Internet, cameras, robotics kit) to promote the learning of the curriculum and not for decoration or play. (MS3b) Teachers share with each other their lesson ideas, media and resources. (MS3c) Premade and saved documents are used as a continuation of prior learning, and may be referred to in current and future learning opportunities. (MS3d)	Students' confidence and regular use of technologies reflect the increased teacher confidence in technology integration. (MS4a) A number of technologies, and the extent of their functions, are integrated into the curriculum during a single lesson. (MS4b) Learning is open-ended and technologies are used to explore the direction that the learning is taking. (MS4c)	Teacher and students are confident in using a variety of technologies together. (MS5a) Teacher and students experiment with the different functions of current and emerging technologies together. (MS5b)

Program Variables (PV)	Lesson includes basic tools or devices, e.g. camera on an iPad. However, the use of these tools is not integrative and does not add to the teaching and learning experience, e.g. teacher records students' learning only to capture the activity. (PV1a)	Lessons include the use of the basic tools (as in PV1a), but the use of the tools is now more integrative and enhances learning (e.g. students are recording themselves on the iPad for retelling; teacher records students' learning for assessment and reporting purposes). (PV2a)	Teacher takes opportunity to use different functions of technologies experimentally and with increasing confidence, to support the teaching and learning of the curriculum. (PV3a)	Teachers across networks (i.e. outside the school) collaboratively share complex resources. There is evidence of joint development of resources across networks. (PV4a) Teacher develops strategies to improve lesson pace and flow by using technologies. (PV4b)	Students and teachers use technologies to allow for authentic audiences and collaborative learning in the learning space. Collaborative projects play a significant part in students' learning, which may include projects across groups, schools and countries. Students and teachers seek information from a variety of sources around the world, including experts in fields. (PV5a) Students and teachers use technologies with the global learning community to share, respond and add to students' learning experiences. Students' learning is a shared responsibility. (PV5b)
Classroom Management and Pedagogy (CMP)	Teacher is the sole user of any digital technology in the learning space. (CMP1a) Lessons with technology are paced identically to those without. (CMP1b) Teacher presents information, and students respond to questioning by teacher using the initiate-response-feedback model. (CMP1c) Technology is used as a reward for core learning. (CMP1d)	Students' use of devices is strictly planned by the teacher and is restricted to technical features such as drag and reveal. (CMP2a) Technology use is most commonly found in teaching those subjects that naturally allow for technology inclusion, e.g. English, rather than dance. (CMP2b) Teacher uses the metalanguage of technology. (CMP2c) Technology use in learning spaces supports teacher-directed and -centred learning. (CMP2d)	Teacher initiates and plans opportunities for students to select technology. (CMP3a) Teacher includes the use of technologies in a growing range of subject areas. (CMP3b) The use of digital technologies is increasingly spontaneous and is used in response to learning, e.g. directing students to answer spontaneous questions using a technology. (CMP3c) Teacher experiments with blending technologies to differentiate learning, and to support students' development of a deeper knowledge and understanding of the curriculum, including literacy and numeracy skills. (CMP3d)	Lessons using technologies have an emphasis on the curriculum, rather than the functions of the technologies, e.g. a lesson on developing a video narrative focuses on aspects of good storytelling, rather than on operating the video recording device. (CMP4a) Technology use in teaching and learning sustains dialogue, and affords students opportunities to demonstrate their learning. (CMP4b) Teacher uses online communities of practice to improve pedagogy and get teaching ideas. (CMP4c)	Teacher demonstrates an intuitive interaction with technologies, resulting in less rigid lesson structures and designs that include learning differentiation and assessments. (CMP5a) Teacher and students have equal say in dictating the direction, momentum and scale of the lesson. (CMP5b) Teacher reflects on their practices using technologies. (CMP5c) Teachers and content experts work collaboratively to share ideas, review lessons and develop new learning that synergistically blends a variety of resources, assessments and activities. These learning experiences emphasise the use of digital technologies in innovative and creative ways. (CMP5d)

Supporting Templates

The following templates are not essential parts of this mentoring process but provide support if required. The mentoring partners should decide upon the best way to take notes, record milestones and strategies, and record the mentee's achievement.

Lesson Observation Field Notes Template

This template provides a simple structure on which to record any significant actions and reactions during the lesson observations. The template is simple to use, allowing the mentor to note the time, or period within the lesson, when a certain action occurred, what action was observed, and any other relevant comment relating to that particular action.

Recording Tool

The Recording Tool provides a template to record a mentee's achievement against the access points in the framework. The Recording Tool is organised by the domains and the access points are grouped by the phase to which they belong. Each 'box' uses the identifier from the framework to delineate each access point.

The Recording Tool assists the mentor to record the date of mentee achievement during a benchmarking or a review cycle. These dates should be entered into the boxes under the relevant access points.

One mentor from the study used this template every week, to assist him with tracking his mentee's growth.

Review Form

This template allows the mentor and mentee to record the mentee's milestones for each cycle. Each milestone should be linked to an access point in the framework, and then the suggested and negotiated strategies should be recorded next to these milestones. No more than five milestones should be decided, and the number of milestones should be determined according to the mentee's particular capacity at that point in time.

Any milestone that was not achieved in the previous cycle should be identified and recorded as one of the milestones for the current cycle.

Lesson Observation Field Notes

Integrating interactive technologies: A practical approach

This template provides a scaffold on which to record significant actions and reactions by the mentee or students during the lesson observation. The notes should assist with the reflection discussions.

Date: ____________________

Mentor: ______________________________ Mentee: __________________________________

Time	**Action**	**Comment** *(e.g. related observations, technology used)*

Other notes:

Recording Tool

Integrating interactive technologies: A practical approach

This template is used in conjunction with the *Interactive Technologies Integration Framework* and allows you to track the skills achieved by the mentee. It is recommended that you consider the technologies used and the curriculum in which they are integrated, as a teacher's skill levels are expected to move up and down on the framework depending on the technology and the curriculum. Achievement should be marked with the date when the access point was achieved. When a teacher is delivering a different curriculum or using different technologies, their achievement should be reassessed by noting their achievement on a new copy of this template.

File management and operating system use	Phase 1 - Replacement		Phase 2 - Supported		Phase 3 - Interactive		Phase 4 - Blended		Phase 5 - Harmony	
	OS1a	OS1b	OS2a	OS2b	OS3a	OS3b	OS4a	OS4b	OS5a	OS5b

Mechanical skills	Phase 1 - Replacement		Phase 2 - Supported			Phase 3 - Interactive			
	MS1a	MS1b	MS2a	MS2b	MS2c	MS3a	MS3b	MS3c	MS3d
	Phase 4 - Blended			Phase 5 - Harmony					
	MS4a	MS4b	MS4c	MS5a	MS5b				

Program variables	Ph 1 - Rep.	Ph 2 - Sup.	Ph 3 - Int.	Phase 4 - Blended		Phase 5 - Harmony	
	PV1a	PV2a	PV3a	PV4a	PV4b	PV5a	PV5b

Classroom management and pedagogy	Phase 1 - Replacement				Phase 2 - Supported						
	CMP1a	CMP1b	CMP1c	CMP1d	CMP2b	CMP2c	CMP2d	CMP2e			
	Phase 3 - Interactive				Phase 4 - Blended			Phase 5 - Harmony			
	CMP3a	CMP3b	CMP3c	CMP3d	CMP4a	CMP4b	CMP4c	CMP5a	CMP5b	CMP5c	CMP5d

Review form

Integrating interactive technologies: A practical approach

This template should be used in conjunction with the *Integrating Interactive Technologies Framework*. At the completion of the reflection meeting, record up to five milestones for the mentee to achieve by the next cycle. Record the access point from which the milestone draws, and provide any practical strategies that would allow the mentee to demonstrate the achievement of the milestone.

Date: ____________________

Mentor: ___________________________ Mentee: ____________________________

Were the previous meeting's milestones achieved? ☐ Yes ☐ No

Comment:

It is advised that any incomplete milestones be revisited in this cycle.

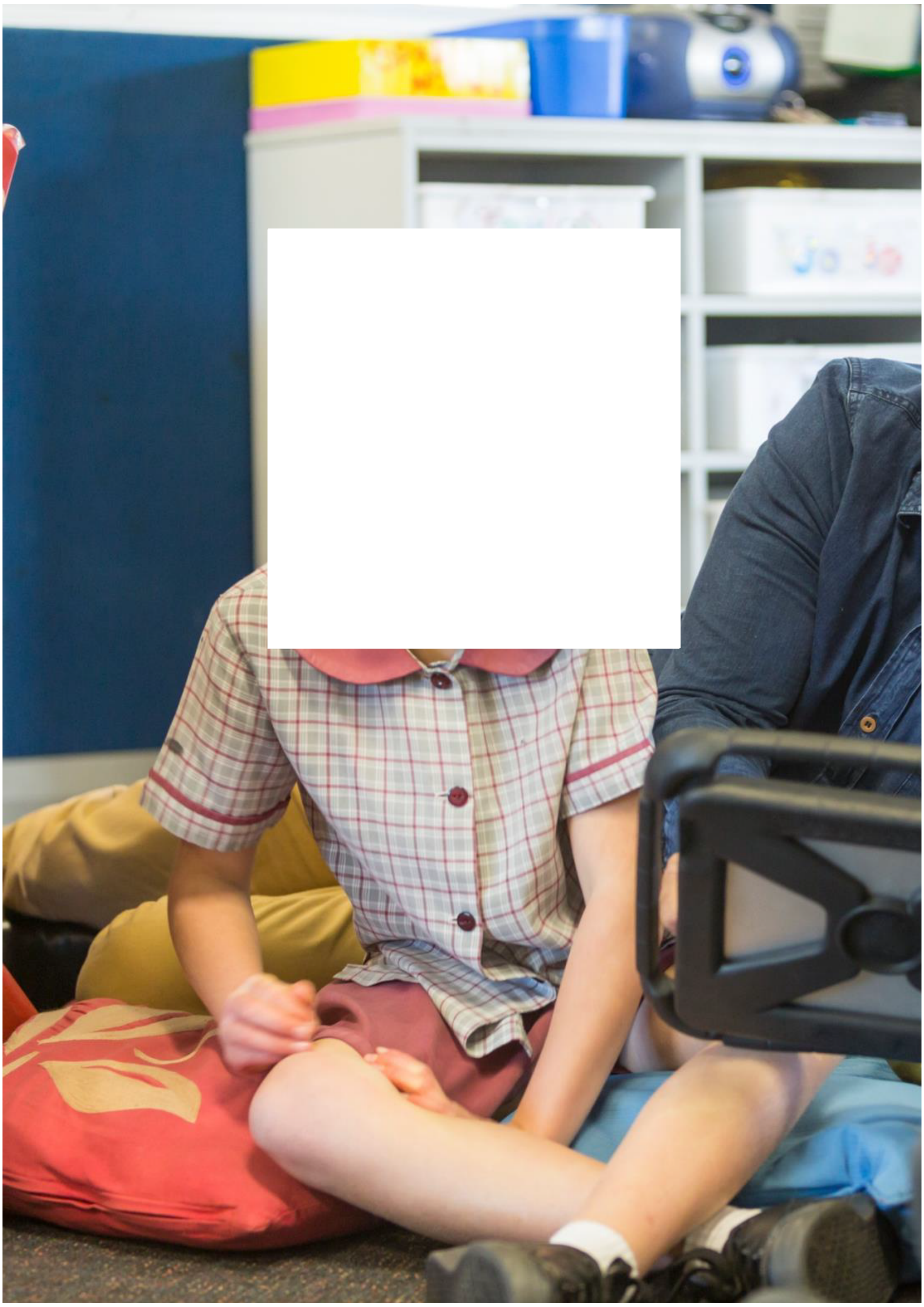
Milestones	Access Point	Suggested strategies
1		
2		
3		
4		
5		

Other notes:

Final remarks

It is intended that the toolkit will undergo ongoing revision and review. This will ensure its continued relevance to teachers. For this reason, I welcome constructive feedback about this toolkit, as well as opportunities to discuss and test ideas with my colleagues.

Feedback can be submitted to integratetech@icloud.com.



Appendix D: Draft Lesson Observation Field Notes template

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Lesson Observation Field notes

Please ensure that during the meeting, all aspects of this form are completed and the meeting audio recorded.

Date: ________________

Mentor: ________________________________ Mentee: ______________________________

Time	Teacher actions	Student actions	Comments *(any other observations, ICT used)*

Notes:

Please collect all lesson plans, handouts, and other relevant documents for review.

Appendix E: Draft Recording Tool

Recording Tool

Appendix A

for the Continuum on teacher's capacity to integrate information and communication technologies (ICT) in classrooms

File Management and Operating System Use	*Stage 1 Substitution*		*Stage 2 Supported*		*Stage 3 Interactive*		*Stage 4 Advance*		*Stage 5 Synergy*	
	OS1a	OS1b	OS2a	OS2b	OS3a	OS3b	OS4a	OS4b	OS5a	OS5b

Mechanical Skills	*Stage 1 Substitution*		*Stage 2 Supported*			*Stage 3 Interactive*			
	MS1a	MS1b	MS2a	MS2b	MS2c	MS3a	MS3b	MS3c	MS3d
	Stage 4 Advance			*Stage 5 Synergy*					
	MS4a	MS4b	MS4c	MS5a	MS5b				

Program Variables	*St 1 Sub*	*St 2 Sup*	*St 3 Int*	*Stage 4 Advance*		*Stage 5 Synergy*	
	PV1a	PV2a	PV3a	PV4a	PV4b	PV5a	PV5b

Classroom Management and pedagogy	*Stage 1 Substitition*				*Stage 2 Supported*						
	CMP1a	CMP1b	CMP1c	CMP1d	CMP2a	CMP2b	CMP2c	CMP2d	CMP2e		
	Stage 3 Interactive				*Stage 4 Advance*			*Stage 5 Synergy*			
	CMP3a	CMP3b	CMP3c	CMP3d	CMP4a	CMP4b	CMP4c	CMP5a	CMP5b	CMP5c	CMP5d

To achieve each stage, teachers need to fulfil all of the stage's access points. Date the access point as each becomes evident.

Appendix F: Draft Review Form

Post-observation Review

Please ensure that during the meeting, all aspects of this form are completed and the meeting audio recorded.

Meeting number: ________________________ Date: ________________

Mentor: ________________________________ Mentee: _____________________________

Were the previous meeting's milestones achieved? Yes / No

Comment: ____

____

It is advised that any incomplete milestones be revisited in this coming development time.

Milestones	Access Point	Strategies
1		
2		
3		
4		
5		

Notes:

____

____

Date of next lesson observation and review meeting: ____

Appendix G: End-of-Study Survey

This is a downloaded version of the survey, which was delivered on an online platform.

Post-Study Survey

Welcome

Welcome to the Program Competition Survey. Thank you for participating in the study. Your participation and input are very valuable. As a final task to this program, please complete this survey as your feedback is important and will help us confirm the data acquired during the study. The mentor and mentee have separate surveys and addresses different areas, based on the role. Please be as honest as you can and take the time to reflect on the process and your role in it. Your information will remain confidential and only the investigators will be able to relate your data to your information. The final reports and any other presentations or publications will maintain your privacy and confidentiality at all times.

Information

Your information is essential to this study, as it will help us correlate your responses to you as a participant. Please be assured that all your information and your responses will be kept confidential and will be protected in all situations, including the final report.

2.2 Please enter your details:

- ○ Name: ____
- ○ School: ____

2.3 In this program, were you the mentor or the mentee?

- ○ Mentor
- ○ Mentee

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Mentor Completion Survey

3.1 Please rate the following statements. My mentee:

	Strongly Disagree	Disagree	Agree	Strongly Agree
was eager to shift and demonstrate growth according to the framework/process.	○	○	○	○
and their skills were easily identified on the framework.	○	○	○	○
was receptive to my suggestions.	○	○	○	○
was an active participant in the partnership.	○	○	○	○

3.2 Please comment on any other aspect specifically about your mentee. You may use the questions above as a starting point.

3.3 Please rate the following statements.

The process/framework:

	Strongly Disagree	Disagree	Agree	Strongly Agree
gave me the tools to provide practical advice to my mentee.	○	○	○	○
was easy to follow.	○	○	○	○
made it easier to mentor, given the explicit instructions and instruments.	○	○	○	○
manageable in terms of time.	○	○	○	○
has helped me improve my integration of ICT.	○	○	○	○
has added to my knowledge of the potential of ICT in education.	○	○	○	○
has useful instruments important to the process.	○	○	○	○
is cost effective.	○	○	○	○
was beneficial to me as the mentor (benefits may include change in pedagogies, learning new strategies etc.)	○	○	○	○

3.4 Please comment on any other aspect specifically about the process or framework. You may use the questions above as a starting point. Please include any changes you feel are necessary.

3.5 Were you afforded more time to observe and meet with your mentee? (i.e. more release from face-to-face)

○ Yes

○ No

3.6 Please comment on the above (if you had more time, was it necessary and helpful?; If not, would it have been useful to have more time?)

3.7 Please rate the following statements.

After the study:

	Strongly Disagree	Disagree	Agree	Strongly Agree
I will continue to work with my mentee to improve their level of ICT integration.	○	○	○	○
I will continue to use this framework.	○	○	○	○
I am happy to mentor other colleagues.	○	○	○	○

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3.8 Please comment on any other aspect specifically about post-study observations or plans. You may use the questions above as a starting point.

3.9 Any other comments?

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Mentee Completion Survey

3.1 Please rate the following statements.

My mentor:

	Strongly Disagree	Disagree	Agree	Strongly Agree
is well-versed in integrating ICT in classrooms.	○	○	○	○
adequately identified my level of understanding for integrating ICT.	○	○	○	○
facilitated my learning progression.	○	○	○	○
was supportive.	○	○	○	○
was available for support.	○	○	○	○

3.2 Please comment on any other aspect specifically about your mentor. You may use the questions above as a starting point.

3.3 Please rate the following statements.

The process/framework:

	Strongly Disagree	Disagree	Agree	Strongly Agree
has been a greater benefit than a one-off course.	○	○	○	○
was easy to follow.	○	○	○	○
manageable in terms of time.	○	○	○	○
has helped me improve my integration of ICT.	○	○	○	○
has helped change my teaching pedagogies.	○	○	○	○
has added to my knowledge of the potential of ICT in education.	○	○	○	○
has useful instruments important to the process.	○	○	○	○
is cost effective.	○	○	○	○

3.4 Please comment on any other aspect specifically about the process or the framework. You may use the questions above as a starting point. Please include any changes you feel are necessary.

Page 7 of 8

3.5 Please rate the following statements.

After the study:

	Strongly Disagree	Disagree	Agree	Strongly Agree
I will continue to work with my mentor to improve my level of ICT integration.	○	○	○	○
I will continue to use the framework.	○	○	○	○
my students are more engaged due to my ability of ICT integration	○	○	○	○
my students are attaining more learning outcomes due to my lessons being more enriched by ICT.	○	○	○	○
I feel confident in mentoring other teachers in integrating at least some aspects of ICT.	○	○	○	○

3.6 Please comment on any other aspect specifically about post-study observations or plans. You may use the questions above as a starting point.

3.7 Any other comments?

Appendix H: Codebook used for analysis

Themes in brackets are sub-themes of those to which they are attached.

Parent	Child	Grandchild	Themes
Relationship	Support	In-lesson Out of class	▪ Preference
	Feedback, encouragement and advice	Use personal example	
	Existing/ Established	Strong rapport	
	Level of	Developing Balanced	
Impact on mentee integration	Mentee skills and attitudes	TK	▪ Limited ▪ Overcoming limitations ▪ Knowledge of tech
		PK	▪ Reinforcing learning ▪ Understanding student skills ▪ Explicit instructions ▪ Differentiation
		TPK	▪ Teaching moments ▪ Classroom management ▪ Scaffolding learning ▪ Combining tech ▪ Revisiting learning ▪ Integrative/Supportive ▪ Student groupings
		TPACK	▪ Community supporting T & L using tech ▪ Combining tech, content and pedagogies
		Stigma of lesson observations	

Parent	Child	Grandchild	Themes
	Access to technology	Reliability	▪ Apps
		Availability	
		Infrastructure	▪ Connectivity (Intermittent)
	Confidence	Change	
	Students' skills and attitudes	Skills	▪ Limited ▪ Natural/existing abilities
		Attitudes	▪ Purpose of tech ▪ Willingness to explore ▪ Peer support ▪ Self-regulation
	Leadership support	School culture	
	Evidence of growth		
	Curriculum used	English	
		Mathematics	
		SciTech	
		History	
		Geography	
Impact on Professional Learning	Mentor skills	TK	▪ Limitations of tech ▪ Metalanguage
		PK	
		TPK	▪ Classroom management ▪ Selection of tools ▪ Scaffold learning using tech ▪ Allowing student voice ▪ Recognition of mentees' skills ▪ Knowledge of tech in T & L

Parent	Child	Grandchild	Themes
		Mentoring strategies	▪ Practical advice ▪ Milestoning (review; identifying; negotiating) ▪ Review Milestones ▪ Providing strategies ▪ Questioning and probing ▪ Explaining
		Development	▪ A need
	Motivation	Altruistic	▪ Culture change ▪ Supporting mentee accreditation
		Personal	
	Reflection	Recounting	
	Leadership support	Direct	
		Protocols/Policies	▪ BYOD ▪ Readiness of tech
		Leadership and direction	▪ Change in leadership ▪ Strategic directions
		Time/RFF	▪ Timetabling
	Mentee attitudes	Receptiveness to advice	
		Positive attitudes to PL	▪ Seeking guidance ▪ Requesting strategies ▪ Seeking clarity
	Future directions		
Feedback on and impact of professional learning, framework and templates	Students' reactions	Enthusiasm	▪ Preference to use tech ▪ Link to previous learning
		Engagement	
		Independence	
	Framework	Language	▪ Simple ▪ Detailed/Explicit ▪ Identifies gaps ▪ Stage confusion

Parent	Child	Grandchild	Themes
		Aesthetics	▪ Outcomes/Indicators ▪ Title ▪ Aligns with other documents
		Function	▪ Scaffold ▪ Use to identify milestones ▪ Regard
	Professional Learning	Instructions	▪ Need more ▪ Sustainability ▪ Value
		Issues with multiple mentors	▪ Different mentors' expertise
		Number of cycles	
		Issues with data gathering	▪ Additional burden
	Templates		
	Beyond case studies		

Appendix I: Example of a personalised information statement

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Teachers Information Sheet

Invitation

You are invited to participate in a study which aims to enhance teachers' capacities to integrate interactive technologies in the classroom. The study is being conducted to fulfil a requirement of a Doctor of Education (EdD) for Perry Wong, under the supervision of Dr Tracey Muir and Dr Greg Oates.

What is the purpose of this study?

In the past few years you will have had some form of interactive technology installed and implemented within your schools. This may have included Interactive Whiteboards, iPods or iPads. The implementation and utilisation of these technologies have not only created many opportunities to improve students' learning, but also presents challenges for teachers to develop capacities to use these effectively and appropriately.

While there has been progress made in teachers' abilities to integrate technology, there is still a growing need for further development including optimum ways in which technologies can enhance students' learning. This study will use a form of continuing professional development to help increase teachers' capacities to effectively use technologies in the classroom.

Specifically this study aims to:

- develop a sustainable structure (in a range of contexts), which allows teachers to develop a mentor/mentee partnership with the aim to improve teachers' capacities in integrating information and communication technologies (ICT);
- provide tools for the mentors/mentees to use that has direct impact on building teachers' capacity to integrate ICT; and
- produce a teacher assessment tool which can be used to assist teachers with effective implementation of ICT in their classrooms.

Why have I been invited to participate?

Participants have been invited to participate from a variety of primary schools, including the following variables:

- a variety of age of students (Kindergarten/Foundation to Year 6)
- government and independent schools; and
- religion-based schools (e.g. Catholic schools).

Furthermore, you have been invited as you and your principal have indicated that you are able to establish a mentor/mentee partnership with another teacher at your school and are able to commit to lesson observations and a consultative mentoring structure.

What will I be asked to do?

If you agree to participate in this study, you will be participating in the following processes:

1. An orientation session in which the investigator will explain the details of the following processes, as well as introducing you and your partner to the instruments which you will use. This may be conducted online.
2. The mentor will observe the mentee and use a checklist to record a number of observations noted during the lesson. This will occur over 5-8 lessons.
3. After each observation, achievements and future directions will be discussed and recorded.
4. At the fifth lesson, the mentor will once again use the checklist to record observation noted during the lesson.
5. The mentor and mentee use the framework as a basis for discussing what occurs in each lesson and where changes in practice may occur.
6. A final survey will be conducted to investigate what worked well and to identify areas of improvement in the process.

The investigator may visit to observe lessons and participate in the mentor/mentee sessions throughout the process. The purpose of these visits is to provide assistance and feedback for the process.

All meetings involving the mentor and mentee will be audio recorded. Field notes will be taken, but no recordings made of classroom observations. Participants will be provided with transcripts of the meetings and you will have the opportunity to review and revise these transcripts as you wish.

We also ask the school to distribute and collect all copies of students' consent. Copies of these will need to be forwarded to the investigator prior to data collection.

It is anticipated that the time required for this study will be an approximate of the following:

Pre-study workshop with researcher: 1 hour

Pre-study assessment: 1 lesson, plus up to 1 hour meeting on the same day as the lesson observed.

Reflection and review: at least 4 lessons. It is up to the mentor and mentee to negotiate these. It is required that at least one lesson observation is made per week, with up to 1 hour meeting on the same day as the lesson.

Post-study assessment: 1 lesson, plus up to 1 hour meeting on the same day as the lesson observed.

Post-study Survey: at least 30 minutes

Depending on your students' ability to comprehend the purpose and their involvement in this study, you may be required to discuss this study with your students and explain the purpose of the consent form. Your students' participation will require both their and their parents/guardians' consent.

Are there any possible benefits from participation in this study?

The purpose of the study is to establish whether a mentor/mentee scenario can work together when integrating ICT in classrooms. Participating in this study will allow you and your school to establish this structure in your school and perhaps establishing it in a wider learning community with your school as a hub.

It is anticipated that this structure could be used within your school to increase teachers' capacity when integrating ICT in classrooms.

Are there any possible risks from participation in this study?

Due to the nature of this study, there should not be any side effects or risks. All personal information or identifying data will be kept completely confidential.

While lesson observations will be made within the classroom context, the purpose of the study is based on teachers' capacities. Comments within the findings may include teacher's interactions with students and their participation within the lessons.

What if I change my mind during or after the study?

Participation in this study is voluntary. Non-participation and withdrawal from participation will not result in any penalty or discriminatory treatment. Any withdrawal will result in any data collected from this specific partnership removed and withdrawn from the study. You may withdraw at any time.

If a student in the mentee's class does not have consent in participating in the study, any referral to the student's actions in the lessons observed will be removed. We ask that you will do this prior to sending the data to the investigator, as you will be most familiar with your students and the nature of their consent. Furthermore, if possible, we ask that these students may be seated in another area of the classroom during the observed lessons, so, while not excluding them from their learning, we can easily identify students we do not have consent for.

What will happen to the information when this study is over?

Please note that all notes and recordings taken during the study will be kept strictly confidential and that only the investigator will have access to these. Continual consultation of the final report will be conducted between the investigator and his supervisors. These consultations may include any specific data from the research process but confidentiality of all participants will be respected.

Participants are asked to respect the confidentiality of other participants.

All relevant meetings between the mentors, mentees and the investigator will be recorded through a voice recorder and then transcribed. All lesson plans developed, assessments and tools specific to this study will be collected. All data collected will be securely locked or password protected if in digital form. Data will be kept for up to five years after publication.

How will the results of the study be published?

This study will be published in threefold:

1. as this is a doctoral study, the study will be bound and presented to the university and assessed by a committee;
2. throughout the study, specific elements may be published in academic journals and presented. The final findings will also be published; and
3. the completed report in digital form will be submitted to the NSW Department of Education (DoE). Furthermore, a summary report will be submitted to the DoE, and any other educational governing bodies and participating schools as required.

What if I have questions about this study?

If you have any questions involving this study, please feel free to contact me at: perry.wong@utas.edu.au.

Other contacts include:

Supervisors:	Dr Tracey Muir
Phone:	03 6324 3261
	Dr Greg Oates
	03 6324 3339
Institution:	University of Tasmania
Phone:	03 6226 2999 (Faculty of Education)

This study has been approved by the Tasmanian Social Sciences Human Research Ethics Committee. If you have concerns or complaints about the conduct of this study, please contact the Executive Officer of the HREC (Tasmania) Network on +61 3 6226 6254 or email human.ethics@utas.edu.au. The Executive Officer is the person nominated to receive complaints from research participants. Please quote ethics reference number H15523.

This study has also been approved:

NSW Department of Education schools: by the State Education Research Applications Process (SERAP);

Catholic Education Office schools: by the CEO of the Diocese your school belongs to; and/or

Other independent schools: through the research application processes of your school.

Appendix J: Example of a consent form

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Integrating Interactive Technologies in Classrooms: A practical approach

Mentee Teachers' Consent Form

1. I have read and understood the Information Sheet for this study.
2. The nature and possible effects of the study have been explained to me.
3. I understand that the study involves:
    - a series of lessons observed by my assigned mentor (see below) with observations recorded of my abilities against the continuum of teacher's capacity to integrate ICT in classrooms.

      I agree to these lesson observations and have these observations noted. I also agree to have my capacity charted against the continuum:

      ☐ Yes ☐ No

    - having the interactions between my mentor and myself audio recorded and transcribed for research purposes.

      I agree to have the interactions between my mentor and me recorded:

      ☐ Yes ☐ No

    - the researcher collecting all notes, audio recordings, lesson plans and any other observations used throughout the process for the research *Integrating Interactive Technologies in Classrooms: a practical approach*.

      I agree to the researcher collecting all notes, lesson plans, recordings and other observations used for research specifically for this study:

      ☐ Yes ☐ No

    - having some of my lessons and sessions with mentor attended by the investigator.

      I agree to have the investigator participating in meetings and lessons pertinent to this study:

      ☐ Yes ☐ No

    - participating in a post-study online survey and provide unbiased feedback about the study.

      I agree to provide unbiased feedback about this study on an online survey:

      ☐ Yes ☐ No

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4. I have received consent from my Principal to participate in this research.
5. I understand that my participation in this study involves low risk.
6. I understand that all research data will be securely stored at the residence of the investigator for up to five years after publication. Physical data, when possible, will be converted to digital and all digital data will be store in an encrypted form on a secure, cloud-based research data facility operated by the Australian Academic Research Network (AARNet): 'CloudStor'.
7. Any questions that I have asked have been answered to my satisfaction.
8. I understand that the investigator(s) will maintain confidentiality and that any information that I supply to the investigator(s) will be used only for the purposes of the research. I understand that in any public documents arising from this research, pseudonyms will be used for my own name and the names of my school and students.
9. I understand that the results of the study will be published so that I cannot be identified as a participant.
10. I understand that my participation is voluntary and that I may withdraw at any time without any effect. If I so wish, I may request that any unprocessed data I have supplied be withdrawn from the research.

I give consent to participate in this study: □ Yes □ No

and my mentor is: ____.

The corresponding mentor's consent form is attached to this form.

Participant's name: ____

Participant's signature: ________________________________ Date: _______________________

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Statement by Investigator

□ I have explained the project and the implications of participation in it to this volunteer and I believe that the consent is informed and that he/she understands the implications of participation.

If the Investigator has not had an opportunity to talk to this participant prior to him/her participating, the following must be ticked:

□ The participant has received the Information Sheet where my details have been provided so the participant has had the opportunity to contact me prior to consenting to participate in this project.

Investigator's name: ____

Investigator's signature: ___________________________ Date: __________________________